

MANIPUR UNIVERSITY

COURSE STRUCTURE

FOR UNDER GRADUATE COURSE: B.Sc (Hons)

(Semester System)

SUBJECT: BOTANY

Semester	Paper No.	Title of the paper	Marks allotted Theory/Practical
I	BOT-101 ELECTIVE	Bot – I (Virus, Bacteria & Cryptogams) I. Virus and Bacteria II. Algae III. Fungi and Plant Pathology IV. Bryophytes V. Pteridophytes	75 15 15 15 15 15
	BOT-101 (P)	Practical	25
II	BOT-202 ELECTIVE	Bot –II (Gymnosperms, Angiosperms, Applied Botany & Embryology) I.Gymnosperms& Palaeontology II. Angiosperms III. Applied Botany & Ethnobotany IV. Anatomy of Angiosperms V.Embryology& Palynology	75 15 15 15 15 15
	BOT-202 (P)	Practical	25
III	BOT-303 ELECTIVE	Bot-III (Plant Geography, Ecology, Plant Physiology & Molecular Biology) I.Plant Geography II.Principles of Ecology III.Plant Physiology IV.Biochemistry V.Molecular Biology	75 15 15 15 15 15
	BOT-303(P)	Practical	25
IV	BOT-404 ELECTIVE	Bot-IV (Cytogenetics, Biotechnology, Biometrics) I.Cytology II. Genetics III. Plant Breeding IV.Biotechnology V.Biometrics	75 15 15 15 15 15
	BOT-404 (P)	Practical	25
V	BOT-505 HONOURS	Bot-V (Microbial Diversity, Plant Pathology &Embryophyta) I.Microbial Diversity II.Microbes and Human Welfare III.Plant Pathology IV.Plant Disease Management V.Bryology and Pteridology	100 20 20 20 20 20

V	BOT-506 HONOURS	Bot -VI (Advanced Plant Taxonomy, Anatomy, Embryology and Palynology) I.Primitive seed plants and Palaeobotany II.Advanced Plant Taxonomy III.Plant Resources- Management & Utilization IV.Anatomy of Angiosperms V.Plant Embryology & Palynology	100 20 20 20 20 20
V	BOT-507 (P) HONOURS	Botany –VII Practical (Based on theory papers BOT 505 and BOT 506)	100
VI	BOT-608 HONOURS	Bot – VIII (Ecology, Plant Physiology & Molecular Biology) I.Vegetation and Natural Resources II.Ecosystem and Pollution III.Plant Physiology IV.Biochemistry V.Molecular Biology	100 20 20 20 20 20
VI	BOT-609 HONOURS	Bot-IX (Cell Biology, Genetics, Plant Breeding, Biotechnology and Computer Application) I.Cell Biology II.Genetics III.Plant Breeding IV.Biotechnology V.Computer Application & Bioinformatics	100 20 20 20 20 20
VI	BOT-610 HONOURS	Bot-X Practical (Based on theory papers BOT-608 and BOT-609)	100

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COURSE STRUCTURE
FOR UNDER GRADUATE COURSE: B.Sc
SUBJECT: BOTANY
SEMESTER – I

BOT -101/ BOTANY PAPER –I (Virus, Bacteria and Cryptogams) **Marks-75**

Unit I:

Virus – General Structure, viral components, classification, nomenclature, viral replication (TMV)

Bacteria – General characters, prokaryotic cell organization, brief account of Berger's classification system, reproduction, brief account on genetic recombination in bacteria, types of nutrition, autotropism (phototropism and chemotropism) and heterotropism.

Marks – 15

Unit II:

Fungi – General characters, classification (Ainsworth), asexual and sexual reproduction, life cycles of *Saprolegnia* (Mastigomycota), *Mucor*(Zygomycota), *Neurospora* (Ascomycota), *Puccinia* (Basidiomycota) and *Penicillium*(Deuteromycota), economic importance of fungi

Lichen – Thallus structure, reproduction and economic importance

Plant Pathology – concepts and classification of plant diseases, causes of plant disease, principles of plant disease management

Marks-15

Unit III:

Algae – General characters, classification (Fritsch), range of vegetation and reproductive structure of different classes, life cycles of *Oscillatoria* (Cyanophyceae), *Oedogonium*(Chlorophyceae), *Vaucheria* (Xanthophyceae), *Cyclotella*(Bacillariophyceae), *Ectocarpus*(Phaeophyceae) and *Polysiphonia* (Rhodophyceae), economic importance of algae

Marks -15

Unit IV: Bryophytes – General characters, classification, alternation of generation, range structural organization of gametophytes and sporophytes, methods of reproduction, life cycles of *Riccia*, *Marchantia*, *Anthoceros*, *Pellia*, *Porella*, *Sphagnum* and *Funaria*

Marks -15

Unit V: Pteridophytes–General characters, classification, anatomy of sporophytes, reproductive methods, life cycles of *Lycopodium*, *Selaginella*, *Equisetum*, *Isoetes*, *Marselia* and *Dryopteris*

Marks-15

BOT-101 (P)/ BOTANY PRACTICAL –I

Marks-25

1. Gram staining of Bacteria
2. Microscopic study of vegetative and reproductive structures of algal genera included in theory syllabus
3. Microscopic study of vegetative and reproductive structures of fungal genera included in theory syllabus
4. Study of lichen thalli – crustose, foliose and fruticose
5. Morphological and microscopic study of vegetative and reproductive structures of bryophytes genera included in theory syllabus
6. Morphological and microscopic study of vegetative and reproductive structures of pteridophytes genera included in theory syllabus

SEMESTER –II

BOT – 202/BOTANY-II (Gymnosperms, Angiosperms, Applied Botany & Embryology

Marks 75

Unit I: Gymnosperms and Palaeobotany

General account of Gymnosperms, classification, morphology, reproduction and life cycle of *Cycas*, *Pinus* and *Gnetum*. Economic importance of Gymnosperms.

Palaeobotany: Fossil formation and types. Geological time scale and dominant fossil flora of different ages

Marks -15

Unit II: Angiosperms Taxonomy

Introduction to Plant Taxonomy, Importance of field work, observation, herbarium preparation, Concept of species, genus and family, Keys of identification. Rules of Nomenclature (validity, effectivity and priority), Classification system of Linnaeus, Bentham and Hooker, Engler and Prantle and Hutchinson

Taxonomic studies of the following families: Ranunculaceae, Brassicaceae, Malvaceae, Fabaceae, Rosaceae, Apiaceae, Asteraceae, Solanaceae, Lamiaceae, Euphorbiaceae, Liliaceae and Poaceae

Marks -15

Unit III: Applied Botany and Ethnobotany

Origin of cultivated plants, Vavilov's centre of origin. Origin, cultivation and improvement of Rice and Potato. History, Cultivation and Processing of Tea. Characteristics and uses of timber yielding plants: *Teak* and *Pinus*. Medicinal plants: *Cinchona*, *Rauwolfia* and *Adhatoda*.

Ethnobotany: Concept, Classification and interdisciplinary approaches

Marks -15

Unit IV: Plant Anatomy

Cell structures, cell wall and cell inclusion. Organization of apical meristem. Structure and distribution of simple and complex tissues. Primary and secondary growth in plants. Anomalous growth in *Amaranthus*, *Mirabilis* and *Dracaena* stem

Marks -15

Unit V: Embryology and Palynology

Plant embryology, Micro and Mega sporogenesis, development of male and female gametophytes, fertilization, embryo and endosperm development.

Palynology: Pollen and spore morphology, Aerobiology and pollen allergy

Marks-15

BOT-202 (P)/BOTANY PRACTICAL –II

Marks -25

1. Temporary stained preparation of the reproductive structures of Gymnosperms included in the theory syllabus
2. Examination of the available specimen/slides of the fossil plants
3. Description and classification of a representative species from each of the angiosperm families mentioned in the theory
Ranunculaceae: *Ranunculus*
Asteraceae: *Ageratum*, *Gynura* and *Spilanthes*
Solanaceae: *Solanum*
Lamiaceae: *Leucas/ Ocimum*
Euphorbiaceae: *Castor*
Liliaceae: onion/ Asparagus
Poaceae: *Dactyloctenium/ Cynodon*
Malvaceae: *Sida/ Urena*
Identification of collected plants from the field
4. Collection and identification of three plants each from cereals, pulses, fibre yielding plants, medicinal plants available in Manipur
5. To prepare a chart containing the starch contents from five important crop plants and protein contents from five pulses by using internet
6. Preparation of temporary slides for the study of anomalous secondary growth in plants included in the theory paper
7. Preparation of stained squashed of pollen motile cells, pollen grains and dissection of endosperm and embryo
8. Field observation of local vegetation and submission of report is compulsory

SEMESTER – III

BOT-303/BOTANY-III (Plant Geography, Ecology, Physiology & Molecular Biology)

Marks -75

Unit I: Plant Geography

Its Scope and importance; Phytogeographical regions of India; factors affecting distribution; plant dispersal, Migration methods, Endemism and barrier of distribution

Marks -15

Unit II: Principles of Ecology

Ecosystem concept, structure and function, ecological pyramids, energy flow and mineral cycling (C,N,P), food chain, food web and trophic levels, structure of plant community, ecological factors (abiotic and biotic factors); ecological adaptation of Xerophytes, Hydrophytes, Ecological succession – hydrosere and xerosere **Marks -15**

Unit III: Plant Physiology

Plant water relationship – diffusion, imbibition, osmosis, water potential and its component; absorption and translocation of water; ascent of sap (theories); mineral nutrition; transpiration – significance, factors affecting transpiration, mechanism of stomatal movement; translocation of solutes; growth and development; concept of photoperiodism and vernalization; photosynthesis; photosynthetic pigment system, cyclic and non-cyclic photophosphorylation, C₃, C₄ and CAM pathways, factors affecting respiration; Biological Nitrogen Fixation- symbiotic and non symbiotic

Marks-15

Unit IV: Biochemistry

Chemical bonds, pH buffer; structure, classification and functions of biomolecules (carbohydrates, lipids, amino acids, proteins, nucleic acids and vitamins); Enzyme – properties, nomenclature and classification as per ECIUB, mechanism of enzyme action, respiration – glycolysis, Krebs's cycle, electronic transport mechanism

Marks-15

Unit V: Molecular Biology

Gene organization of Prokaryotes and Eukaryotes; structure and physical properties of DNA and RNA; biosynthesis of nucleic acids; DNA – replication; RNA translation **Marks-15**

BOT-303 (P)/BOTANY PRACTICAL –III

Marks 25

1. Preparation of map of phytogeographical regions of India
2. Determination of the minimum size of the quadrat by species area curve method
3. Determination of frequency of vegetation in a community by quadrat method
4. Determination of osmotic potential of vacuolar sap by plasmolytic method using *Rhoeo/ Tradescantia* leaf or onion peel
5. Determination of rate of transpiration by Ganong's Potometer
6. Extraction of chlorophyll pigments from leafy plants by paper chromatographic technique
7. Study of rate of photosynthesis under different light intensities
8. Determination of RQ of plant materials having fats, proteins
9. Simple tests for carbohydrate, protein, fats and nucleic acids
10. Preparation of buffer phosphate and Tris acetate buffer
11. Isolation of DNA from plant seedings
12. Field observation of local vegetation and submission of report is compulsory

SEMESTER –IV

BOT-404/BOTANY-IV (Cytogenetics, Biotechnology and Biometrics) Marks -75

Unit I: Cytology

Marks -15

General accounts of organization and function of cell and its components; cell wall; plasma lemma, endoplasmic reticulum, golgi apparatus, ribosomes, mitochondria, plastids and nucleus. Structure and function of chromosome, mitosis and meiosis – their significance

Unit II: Genetics

Marks-15

Mendelism: Law of segregation and independent assortment; back cross and test cross; Gene interaction; Gene expression; Structure of gene; transfer of genetic information; transcription; translation. Protein synthesis; t-RNA. Linkage and Crossing over, mutation and mutagens, chromosome alterations – deletions, duplications, translocations, inversions; variation in chromosome number; aneuploidy, polyploidy. Extra-nuclear inheritance: sex chromosome and sex determination in plants

Unit III: Plant Breeding

Marks- 15

Principles of Plant breeding; breeding behaviour, sexual, asexual, apomixes polyembryony; breeding methods – conventional; methods of breeding in self and cross pollinated crops; heterosis

Unit IV: Biotechnology

Marks-15

Basic aspects of plant tissue culture; cellular totipotency; differentiation and morphogenesis; Genetic Engineering in plant improvement; application of plant biotechnology in medicine, agriculture and human welfare

Unit V: Biometry

Marks-15

Scope and application; collection of data; Sample and sampling – theory and methods; mean, mode, median and standard deviation; probability; chi-square test and analysis

BOT-404/BOTANY PRACTICAL

Marks -25

1. To study cell structure from onion leaf peel, demonstration of staining and mounting methods
2. Comparative study of cell structure in Onion cells, *Spirogyra*; study of cyclosis in *Tradescantia* staminal cells
3. Study of plastids to examine pigment distribution in plants (e.g. *Cassia capsicum*)
4. Examination of electron micrographs of eukaryotic cells with special reference organelle
5. Examination of various stages of mitosis and meiosis using appropriate land material (e.g. Onion root tips, onion flower buds, *Rheo*, *Tradescantia*)
6. Working out the law of inheritance using seed mixtures
7. Callus induction, organogenesis and plant regeneration (rice mature embryo)
8. Protoplast isolation eg. Tobacco, proteins
9. Preparation of tissue culture media sterilization and inoculation of plant material
10. Analysis of data for mean, mode, median and standard deviation

SEMESTER –V

BOT-505/BOTANY – (Microbial Diversity, plant Pathology and Embryophyta)

Marks-100

Unit I: Microbial Diversity

History of microbiology, five kingdom system of classification, Carl Woese's Three Domains of living organism (Archaeobacteria, Bacteria and Eukaryotes), microbial forms – viruses (including prions and viroids), archaebacterial, bacteria, algae, fungi and protozoa their characteristic features, microbiology of soil, air and water

Marks-20

Unit II: Microbes and Human Welfare

Role of microbes in industry (alcohol, antibiotics, organic acid, enzymes, proteins, vitamins, biofuel), agricultural microbiology (biofertilizers and biopesticides), food microbiology (food spoilage and food preservation), medical microbiology (microbes as pathogenic organisms)

Marks-20

Unit III: Plant Pathology

History of plant pathology, Koch's postulates of Host pathogen interrelation, classification of plant diseases on the basis of causal organisms and symptoms, studies on symptoms, disease cycles and control measures of the following diseases – damping-off of seedlings, late blight of potato, white rust of crucifers powdery mildew of pea, blast of rice, stem rust of wheat, leaf blight of paddy, citrus canker and TMV

Marks-20

Unit IV: Plant Disease Management

Plant quarantine, seed certification, cultural practices, fungicides (classification on the basis of chemical nature and mode of action), biological control, breeding for resistant varieties, genetically modifies plants (merits and demerits), concepts of integrated pest disease management

Marks-20

Unit V: Bryology and Pteridology

Bryophytes as the first land plants, evolutionary trend ecological and economic importance of bryophytes, brief account on the development of Bryology in India.

Origin and evolution in pteridophytes, relationship of pteridophytes with bryophytes and gymnosperms, heterospory, seed habit and stellar evolution in pteridophytes, ecological and economic importance of pteridophytes

Marks -20

BOT-506/BOTANY – VI (Advanced Plant Taxonomy, Anatomy, Embryology and Palynology)

Marks – 100

Unit I: Primitive seed plants and Palaeobotany

Concept of Progymnosperms, Diversity among Gymnosperms and their distribution in Indian sub-continent. Origin and Evolution of Gymnosperms. Salient features and life cycle of Ginkgo, Taxus and Ephedra. Fossil algae and fungi. Primitive land plants: Rhynial, Lepidodendron, Calamites and Sphenophyllum. Fossil Gymnosperm orders –

Cycadofilicales, Bennettitales and Palaeobotany in the exploration of fossil fuel

Marks- 20

Unit II: Advanced Plant Taxonomy

Objective, Principles and Practices of Plant Taxonomy, Methods and techniques of herbarium preparation, Development of chemotaxonomy. Cytotaxonomy and Numerical taxonomy. Biosystematics, Taxonomy on the web: Molecular Taxonomy Application of DNA hybridization technique in plant taxonomy; Importance of biochemical markers and DNA markers in taxonomic studies. Role of Botanical Survey of India and Taxonomic literatures. Classical system of Classification Bentham and Hooker Taxonomic studies affinities and economic importance of the following Families: Magnoliaceae, Asteraceae, Rutaceae, Anacardaceae, Myrtaceae, Cucurbitaceae, Dipterocarpaceae, Polygonaceae, Moraceae, Rubiaceae, Apocynaceae, Asclepiaceae, Acanthaceae, Verbenaceae, Araceae, Scitamineae (Musaceae, Zingiberaceae, Cannaceae and Marantaceae), Orchidaceae and Cyperaceae

Marks-20

Unit III: Plant Resources – Management and Utilization

Classification of economic plants based on their uses. Cyanobacteria: Spirulina. Origin, cultivation and improvement of Maize, Mustard, Pea and Banana. History, cultivation and processing of Rubber. Characteristics and uses of timber yielding plants: Dipterocarpus, Phoebe and Melanorrhoea. Medicinal Plant: Ephedra, Carthamus, Aloe vera and Vinca.

Pharmacognosy: Aims and Objects, Collection and preparation of drugs. Importance of ethnobotany in genepool and germplasm conservation

Marks-20

Unit IV: Anatomy of Angiosperm

Apical meristem and histological theories of shoot and root apices. Vascularization: primary shoots of monocotyledons and dicotyledons. Formation of internodes, branching pattern, monopodial and sympodial growth. Root stem transition, Cambium and its function; formation of secondary xylem, characteristics of growth ring, sapwood and heartwood. Secondary phloem, stomata and their types. Anomalous secondary growth in Bauhinia, Bougainvillea and Nyctanthus

Marks-20

Unit V: Plant Embryology and Palynology

Plant Embryology: Microsporangium and types of pollen tetrad. Megasporangium and types of mega gametogenesis. Pollen pistil interaction, compatibility and incompatibility, syngamy and triple fusion. Development, structure and function of endosperm. Types of huastoria, Embryogeny – types. Development of monocot and dicot embryos, suspensor, synergid, polyembryony, apomixes and their role. Pollen production and dispersion in space and time. Role of pollen in taxonomy. Application of palaeopalynology, melisso-palynology and forensic palaeopalynology

Marks-20

BOT-507(P)/BOTANY VII PRACTICAL (Based on theory paper BOT-505& BOT-506)

Marks-100

1. Preparation of culture media for bacteria and fungi (nutrient agar and PDA)

2. Isolation of microorganisms (bacteria and fungi) from soil/water/air
3. Pure culture maintenance of bacteria and fungi
4. Staining of bacteria and fungi
5. Microscopic study of *Bacillus*, *Coccus*, *Staphylococcus*, *Spirillum*, *Escherichia*, *Nostoc*, *Anabaena*, *Saccharomyces*, *Candida*, *Aspergillus*, *Trichoderma*
6. Morphological and anatomical studies of different types of root nodules (pea, broad bean, Mimosa, Sesbania)
7. Demonstration of Koch's postulates
8. Symptoms; causal organisms and microscopic studies of diseased plant specimens included in theory syllabus
9. Demonstration of commercial fungicides and equipments for field application
10. Comparative studies of thallus and reproductive structures of *Riccia*, *Anthoceros* and *Polytrichum*
11. Comparative studies of morphological and anatomical structures of *Lycopodium*, *Selaginella*, and *Marsilea* in relation to stellar evolution and heterospory
12. Gymnosperm and Palaeobotany:
 Ginkgo and Taxus – Temporary mounts of transverse sections of young and mature stems, radial section and maturation secondary wood; transverse and vertical sections of needle; whole mounts of mature microspores, young and mature embryo
 Ephedra – T.S. of node and internode of stem, whole mount of epidermal peel, L.S. of leaf, microspores and embryos; permanent preparation of anther and ovule
13. Examination and classification of specimen/slides of the fossil plants as per syllabus
14. Advance Plant Taxonomy: Description and classification up to genus of a representative species from each of the angiosperm families mentioned in the theory
 Magnoliaceae: *Michelia*
 Brassicaceae: *Brassica/Cardamine*
 Rutaceae: *Citrus*
 Fabaceae: *Crotalaria/Vigna/Cassia/Caesalpinia/Mimosa/Acacia*
 Myrtaceae: *Callistemon/Eucalyptus*
 Anacardiaceae: *Mangifera*
 Cucurbitaceae: *Luffa*
 Rubiaceae: *Mussaenda*
 Apocynaceae: *Vinca*
 Asclepiadaceae: *Calotropis/Asclepias*
 Acanthaceae: *Justicia/Adhatoda*
 Verbenaceae: *Duranta/Lantana*
 Polygonaceae: *Polygonum*
 Orchidaceae: *Vanda/Dendrobium*
 Scitaminae: *Musa/Canna/Maranta/Zingiber*
 Araceae: *Phoenix*
 Cyperaceae: *Cyperus*
15. Utilization of plants and Ethnobotany: Collection and identification of five plants each used as a source of carbohydrate, protein, wood, oil-seed, spice and condiments and drugs. Preparation of charts containing the percentage of carbohydrate content, protein content, oil content from five different species each from internet data
16. Anatomy: Preparation of permanent/ semi permanent slides for the study of anomalous secondary growth in plants included in the theory paper (Double Staining)

17. Embryology and Palynology: Examination of cleared and dissected whole mount permanent preparation of various structures mentioned in theory paper. Preparation of stained slides of endosperm and embryo. To study the germination percentage of pollen grains. Preparation of pollen slides by acetolysis method. Description and illustration of six selected pollen/ spore types.
18. Identification and preparation of field notes of 50 plant species in the field
19. An external field study tour to nationally important botanical gardens/herbaria/sanctuaries/ research laboratories, etc. and submission of the study report is compulsory

SEMESTER VI

BOT-608/BOTANY-VIII (Ecology, Plant Physiology & Molecular Biology) Marks-100

Unit I: Vegetation and Natural resources: detailed study of the vegetation and floristic regions of India- evergreen, deciduous, mangrove forest. Natural resources – forest resources, conservation, afforestation, social forestry, agro forestry – timber extraction, dams and their effects, Mineral resources, Water resources – floods, drought, Energy resources – renewable and non renewable resources **Marks – 20**

Unit II: Ecosystems and Pollution: Physical environment, biotic environment; biotic and abiotic interaction, concept of habitat and niche. Ecosystem – basic component of ecosystem. Energy flow in ecosystem, trophic levels.

Environmental Pollution – major pollutants, air, water and solid pollution – control measures; Climate Change and Global Warming – environmental revolution, Biodiversity – concept of biodiversity. **Marks - 20**

Unit III: Plant Physiology: Absorption of water, absorption of mineral elements – roots as absorbing surfaces, active and passive absorption. Physiological role of micro and macro elements – their deficiency symptoms. Phases of Growth – growth curve, Plant hormones (Auxins, Gibberellins, Cytokinines, Ethylene, Abscissic acid), physiological functions, senescences photoperiodism, physiology of flowering, Photomorphogenesis: phytochromes, physiological role. Photosynthesis – significance, light reactions, Calvin cycle, photorespiration, Laws of limiting factors, chemosynthesis – a brief account, Pentose Phosphate Pathway, Biological Nitrogen Fixation – mechanism, elementary knowledge of Nif, Nod Hup genes and leghaemoglobin. Stress plant physiology (Principles and Application) **Marks – 20**

Unit IV: Biochemistry: Water as universal solvent, weak interactions in aqueous system, Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics and colligative properties). Bioenergetics, Enzymes and enzyme kinetics, enzyme regulation, Isozymes; Respiration – Glycolysis, Krebs's cycle; Fermentation, Oxidative phosphorylation, ATP synthesis. Biosynthesis of Nucleic acids and Protein synthesis. **Marks – 20**

Unit V: Molecular Biology: Gene structures, expression and regulation; Gene organization in prokaryotes and eukaryotes; Operon concept; Gene regulation in prokaryotes and eukaryotes, positive and negative gene regulation; interrupted genes in eukaryotes; RNA splicing; mRNA stability.

Recombinant DNA Technology; Restriction endonucleases prokaryotic and eukaryotic clone vectors; genomic and DNA libraries; various techniques of gene mapping and concept of DNA Fingerprinting; Polymerase Chain Reaction; DNA sequencing.

Nucleic acid: Composition of nucleic acids; DNA Structure; A,B and Z forms of DNA; denaturation and renaturation of DNA; Chromatin structure; DNA replication and recombinations; DNA polymerases; different forms of RNA. **Marks -20**

BOT-609/BOTANY –IX (Cell Biology, Genetics, Plant Breeding, Biotechnology and Computer Application) **Marks – 100**

Unit I: Cell Biology:

The Cell: Historical background; Cell theory. Kingdom-wise cell size and cell structure; Comparative account of prokaryotic and eukaryotic cell; Characteristics of archaebacteria and mycoplasma. Nucleus and Ribosomes: Ultrastructure; nuclear envelope and nuclear pore complex, nuclear matrix and nucleoplasm; DNA and Histones; nucleosome and higher level of organisation; centromere and telomere. Ribosome structure – prokaryotic and eukaryotic; organelle ribosomes and their functional significance. Mitochondrion and Chloroplast: origin, structure and biogenesis; Organelle membrane and organization of macromolecular complexes; variation in size, shape and number types of plastids; organelle nuclear interactions, organelle gene organization. Structure and function of Golgi Complex; Endoplasmic Reticulum; Lysosomes, microbodies peroxysome and lyoxysome. Cytoskeleton Cell membrane: Origin, ultrastructure; chemical constituents and models of Cell membrane Organisation; roles of various membrane proteins, lipids and carbohydrates; role of ion channels and pumps in cellular and signalling **Marks -20**

Unit II: Genetics

Mendels' experiment and principles of inheritance; Back Cross and Test Cross; Gene Interactions and modified dihybrid ratios – Complementary, Supplementary, Epistatic and Duplicate factors. Multiple allelism; Multiple alleles in *Drosophila* (eye colour), Man (Blood groups), Plants (self –incompatibility)

Quantitative genetics: Quantitative traits and quantitative genetics; the multiple factor hypothesis **Marks -20**

Unit III: Plant Breeding

Types of plant reproduction: vegetative, sexual and apomixes; their effects on generating and fixing genotypic variation

Methods of plant improvement: Pure line and mass selection; hybridization in self and cross pollinated crops; introduction and acclimatization, Hybrid Vigour; Mutation and Polyploidy as methods of Plant improvement **Marks-20**

Unit IV: Biotechnology

History, definition and scope; Cellular differentiation and totipotency; Organogenesis and Embryogenesis; Protoplast isolation and culture; Somatic hybridization; Clonal propagation; Genetic engineering of plants; Vectors for gene delivery; Selectable markers and reporter genes; methods of gene delivery; Agrobacterium – the natural genetic engineer; salient achievements in crop biotechnology (with suitable examples) and prospects. **Marks- 20**

Unit V: Computer application and Bioinformatics

Computer organization programming principles; programming language; Internet and its applications; communication tools – word processing, spread sheet and presentation of software; Concept of database, Applications of Computer in Biological sciences; introduction to biostatistical analysis of data; Application software for Botany.

Bioinformatics – introduction and assessment of bioinformatics tools.

Marks -20

BOT-610(P)/BOTANY-X PRACTICAL (based on theory papers BOT-608 & BOT-609)

Marks -100

1. Field observation of local vegetation
2. Study of structure of a plant community by random and belt transect methods
3. Determination of density and abundance of vegetation in a community by using minimum size of quadrat
4. Determination of physical characteristics of soil like pH, Temperature and Moisture Content
5. Water analysis (determination of chlorine, dissolved CO₂ and O₂ in water and measurement of pH)
6. Determination of dissolved oxygen and biochemical oxygen demand (BOD) of unpolluted and polluted water
7. Determination of stomatal frequency using leaf epidermal peeling/impression
8. Separation of plant pigment by paper chromatography technique and chemical method
9. Isolation of chloroplast and demonstration of Hills activity
10. Estimation of starch in photosynthesizing leaves
11. Estimation of protein by Bradford method
12. Paper chromatography separation of amino acids
13. Measurement of pH of beet, carrot, potato, tuber, Amaranthus – leaves and sap of water hyacinth
14. Study of cell structure from onion leaf peels; demonstration of staining and mounting methods
15. Comparative study of cell structure in Onion cells, *Hydrilla* and *Spirogyra*. Study of cyclosis in *Tradescantia* stamina/cells hairs
16. Study of plastids to examine pigment distribution in plants (eg. *Cassia*, *Lycopersicum*, *Capsicum*)
17. Examination of electron micrographs of eukaryotic cells with special reference to organelles
18. Study of various stage of mitosis and meiosis using appropriate plant material (eg. root tips, flower buds of onion/pea/broad bean)
19. Determination of chromosome counts from dividing pollen mother cells, root tips and pollen grains
20. Preparation of karyotypes
21. Detection of aromatic chromosome pairing and disjunction caused by mutant genes and structural alterations of chromosome
22. Preparation of chromosome maps from 3-point test cross data
23. Correlation of floral structure with pollination system (eg. *Salvia*, *Saramum*, *Pisum*, *Lathyrus*, *Triticum*, *Oryza*, *Ricinus*)
24. Field exploration for detection of male sterile plants and estimation of their pollen fertility in locally grown crop plants e.g. tomato, lenum etc

25. Estimation of pollen ovule ratios and its bearing on pollination system
26. Emasculation and bagging of flowers of Brassicaceae, Poaceae, Papilionaceae, Malvaceae etc. pollinating them manually and estimating fruits and seed set
27. Preparation of tissue culture media, sterilization and inoculation of plant materials
28. Demonstration of techniques of *in vitro* culture of various explants
29. Isolation of plant protoplasts (eg. tobacco, petunia) using enzyme available commercially and estimation of their yield
30. Isolation, purification of DNA from plant materials
31. Separation of DNA fragments through gel electrophoresis
32. Isolation of plasmids for *Bacillus/Pseudomonas*
33. Hybridization experiments –F₁ and available F₂ materials analysis for Specific character
34. Determination of mean, standard deviation, using MS Excel/SPSS
35. Preparation of presentation of cell organelles, using MS powerpoint or similar package
36. Retrieving the botanical articles from internet