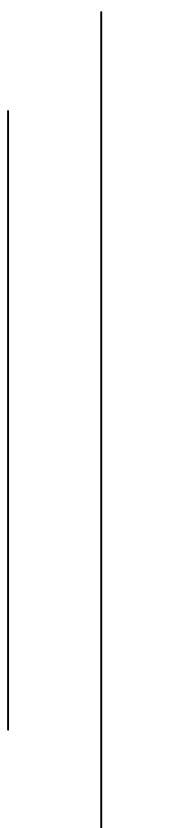


GOVERNMENT OF MANIPUR

MAYAI LAMBI COLLEGE

YUMNAM HUIDROM, IMPHAL WEST



BA / BSc Syllabus

DEPARTMENT OF BOTANY

Syllabus for Under Graduate
Programme

Bachelor of Science in Botany



Manipur University, Canchipur
Imphal-795003

**MANIPUR UNIVERSITY
COURSE STRUCTURE
FOR UNDER GRADUATE COURSE: BSc.**

SUBJECT- BOTANY

SEMESTER-1

BOT- 101/BOTANY PAPER-I (Virus, Bacteria and Cryptogams)

Mark: 75

Unit I: Virus -General Structure, viral components, classification, nomenclature, viral replication (TMV)

Bacteria-General character, prokaryotic cell organization, brief account of Bergey's classification system, reproduction, brief account on genetic recombination in bacteria, types of nutrition, autotrophism (phototrophism and chemotrophism) and heterotrophism.

Unit II: Fungi-General characteris, classification (Ainsworth), asexual and sexual reproduction, life cycles of Saprolognia (Mastigomycota), Mucor (Zygomycota), Neurospora (Ascomycota), Puccinia(Basidiomycota) and Penicillium (Deuteromycota), economic importance of fungi.

Lichens - Thallus structures, reproduction and economic importance

Plant Pathology- Concepts and classification of plant disease, causes of plant disease, Principles of plant disease management.

Mark: 15

Unit III: Algae- General characters, classification (Fritsch), range of vegetative 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.

Mark: 15

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

Mark: 15

Unit V: Pteridophytes- General characters, classification, anatomy of sporophytes, reproductive methods, life cycles of Lycopodium, Selaginella, Equisetum, Isoetes, Marsilea and Dryopteris.

Mark: 15

BOT-101(P)/BOTANY PRACTICAL- I

1. Gram staining of bacteria
2. Microscopic study of vegetative and reproductive structure of algal genera included in theory syllabus.
3. Study of lichen thalli- crustose, foliose and fruticose.
4. Study of locally important plant diseases.
5. Morphology and microscopic study of vegetative and reproductive structures of bryophyte genera included in theory syllabus.
6. Morphology and microscopic study of vegetative and reproductive structures of pteridophyte genera included in theory syllabus.

1.	Introductin to Mycology	:	C.J. Alexopoulos and C.W. Mims Willey Eastern Ltd. , New Delhi.
2.	An Introductin to Mycology	:	R.S. Mehrotra and K.R. Aneja New Age International (P) Ltd., New Delhi
3.	The Structure and Reproduction of the Algae Vol. I & II.	:	F.E. Fritsch Cambridge University Press, London.
4.	Introduction to Phycology	:	H.D. Kumar East-West Press Pvt. Ltd., New Delhi.
5.	Introduction to Embryophyta	:	N.S. Parihar
	(a) Vol. I Bryophyta	:	Kitab Mahal, Allahabad
	(b) Vol. II Pteridophyta	:	
6.	The Morphology of Pteridophytes	:	K.R. Sporne B.I. Publications, Bombay
7.	Microbiology: Principles and Explorations	:	J.G. Black John Wiley and Sons, Inc. USA
8.	The Algae	:	V.J. Chapman and D.J. Chapman Memillan India Ltd.

Mark: 15

Mark: 15

Mark: 15

Mark: 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.

Mark: 15

BOT-202(P) BOTANY PRACTICAL-II

Mark: 25

Gymnosperms and Palaeobotany:

1. Temporary stained preparation of the reproductive structures of Gymnosperms included in the theory.
2. Examination of the available specimens/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
Apiaceae: Coriandrum
Asteraceae: Ageratum, Gynura & Spilanthes.
Solanaceae: Solanum
Lamiaceae: Leucas/Ocimum
Euphorbiaceae: Castor
Liliaceae: Onion/Asparagus
Poaceae: Dactyloctenium/ Cynodon
Malvaceae: Sidal 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.

Recommended Books:

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| 1. | Economic Botany | : | A.F. Hill
Tata McGraw-Hill Publishing Co.,
New Delhi |
| 2. | The Embryology of Angiosperms | : | S.S. Bhojwani & S.P. Bhatnagar
Vikas Publishing House Pvt. Ltd.,
New Delhi. |
| 3. | Palynology | : | M.R. Saxena
Oxford & IBH Publ. Co. Ltd. New
Delhi. |
| 4. | Morphology of Gymnosperms | : | J.M. Coulter & C.J. Chamberlain
Central Book Depot, Allahabad |
| 5. | Taxonomy of Vascular Plants | : | G.H.M. Lawrence
Oxford & IBH Publ. Co. Ltd. New
Delhi. |
| 6. | A Handbook of Field and Herbarium
Methods. | : | S.K. Jain & R.R. Rao
Today & Tomorrows Print & Publ.
New Delhi |
| 7. | A Manual of Ethnobotany | : | S.K. Jain Scientific Publications
Jodhpur. |

SEMESTER-III

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

Mark: 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. Mark: 15

Unit II: Principles of Ecology, Ecosystem concept, structure and function, ecological pyramids, energy flow and, mineral cycling (CNP), food chain, food web and trophic levels, structure of plant community, ecological factors (abiotic and biotic factor); ecological adaptation of xerophytes, hydrophytes, ecological succession - hydrosere and xerosere. Mark: 15

Unit III: Plant Physiology: Plant water relationship-diffusion, imbibition's, 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; Photosynthesis pigment systems, cyclic and non-cyclic photophosphorylation, C_3 , C_4 and CAM path ways, factors affecting photosynthesis; respiration- aerobic, anaerobic, factors affecting respiration; biological Nitrogen fixation -symbiotic and non-symbiotic. Mark: 15

Unit IV: Biochemistry: Chemical bonds, pH, buffer, structure, classification and function of biomolecules (carbohydrates, lipids, amino acids, protein, nucleic acids and vitamins), enzyme-properties, nomenclature and classification as per ECIUB, mechanism of enzyme action, respiration-glycolysis, Krebs cycle, electron transport system. Mark: 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, mechanisms of protein synthesis. Mark: 15

BOT-303(P)/BOTANY PRACTICAL-III

Mark: 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 plasmolysis method using Rheo/Tradescantia leaf and 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, protein.
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 seedlings.
12. Field observation of local vegetation and submission of report is compulsory.

Recommended Books:

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| 1. Basic Ecology | : | Odum, E.P.
Saunders, Philadelphia, USA |
| 2. Concepts of Ecology (3rd Ed.) | : | Kormondy, E. |

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| 3. | Ecology, Environment and Resource Conservation | : | Singh J.S. Singh S.P. and Gupta S.R.
Anamaya Publishers, New Delhi. |
| 4. | Fundamentals of Ecology | : | Odum E.P.
Prentice Hall of India, New Delhi. |
| 5. | Plant Physiology | : | Salisbury F.B. and Ross C.W.
Wassworth Publ.Co. /CBS Publ. & Dist, Delhi |
| 6. | Plant Physiology | : | Bidwell R.G.S |
| 7. | Plant Physiology | : | Devlin RM & Francis H. Witham
Fourth Edn. CBS, New Delhi |
| 8. | Outlines of Biochemistry | : | Conn E.E. P.K. Stumft, G. Bruerning and R.H. Doi John Willey & Co., New York |
| 9. | Biochemistry | : | Stryer L.
W.H. Freeman & Co., New York |
| 10. | Principles of Biochemistry | : | Lehninger A.I., Nelson D.L. & Cox M.M.
CBS Publ. Delhi. |
| 11. | Cell and Molecular Biology | : | De Robertis EMF & EDP De Robertis
BI Waverly Pvt. Ltd. |
| 12. | Molecules Biology of Cell | : | Bruce Alberts <i>et al.</i>
Garland Publications. |

SEMESTER-IV

BOT-404/BOTANY-VI (Cytogenetic, Biotechnology and Biometrics)

Marks: 75

Unit I: Cytology:

General accounts of organisation and function of cell and its components: Cell wall; plasma lemma; endoplasmic reticulum; of chromosome. Mitosis and meiosis their significance.

Marks: 15

Unit II: Genetics:

Mendrlism: 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, translocation, inversions; variation in chromosome number: aneuploidy, polyploidy, Extra-nuclear inheritance: Sex chromosome and sex determination in plants.

Marks: 15

Unit III: Plant Breeding:

Principles of plant breeding: breeding behaviour, sexual, asexual, apomixes, polyembryony; breeding methods- conventional; methods of breeding in self and cross pollinated crops; heterosis.

Marks: 15

Unit IV: Biotechnology:

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. Marks: 15

Unit V: Biometry:

Scope and application; collection of data. Sample and sampling - theory and methods; mean, mode, median and standard deviation; probability; chi-square test and analysis. Marks: 15

BOT-404/BOTANY-IV

Marks: 25

1. To study cell structure from leaf peel, demonstration of staining and mounting methods.
2. Comparative study of cell structures in Onion cells, Spirogyra: Study of Cyclosis in Tradescantia staminal cells.
3. Study of plastids to examine pigment distribution in plants (e.g. Cassia and capsicum).
4. Examination of electron micrographs of eukaryotic cells with special reference to organelle.
5. Examination of various stages of mitosis and meiosis using appropriate land materials (e.g. Onion root tips, Onion flower buds, Rheoe, Tradescantia).
6. Working out the law of inheritance using seed mixtures.
7. Callus induction, organogenesis and plant regeneration (rice mature embryo).
8. Protoplast isolation e.g. 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.

Recommended Book:

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| 1. | Molecular Biology of Cell | : | Albors, GB, Bray, D., Lewis J, Raf, M, Roberts, K. & Naten, L.D. Garland Publ.Co., New York. |
| 2. | Molecular Cell Biology | : | Lodish, H., Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, D. & Darnel, J. W.H. Freeman & Co., New York |
| 3. | Principles of Genetics | : | Gardner E.J., Snustad, D.P. & Simmons S., M.J. John Wiley & Sons, USA |
| 4. | Molecular Cell Biology | : | Nolfe, S.H. |

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| 5. | Plant Tissue Culture: Application & Limitations | : | Bhojwani S.S.
Elsevier Science Publ. New York |
| 6. | Breeding Field Crops | : | Pachalman, J.M. & Sleeper, D.R.
Longman, London, & New York |
| 7. | Principles & Practice of Plant Breeding | : | Sharma J.R.
Tata McGraw-Hill Publ. Co., New Delhi |
| 8. | Ecology Work Book | : | Misra, R.
Oxford University Press, Calcutta |
| 9. | Plant Micro technique | : | Johansen D.A.
McGraw-Hill Book Co., New York |
| 10. | Chromosome Technique (Theory & London Practice). | : | Sharma, A. & Sharma, A. Butterworths, |

SEMESTER -V

BOT -505/BOTANY -V (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), archaeobacteria, 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 acids, enzymes, protein, vitamins, biofuel), agricultural microbiology, (bio fertilizers and bio pesticides), 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 of symptom, 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, generally modified plants (merits and demerits), concept 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

Recommended Books:

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| 1. | Plant Diseases | : | R.S. Singh
Oxford & IBH Publ. Co., New Delhi |
| 2. | Introduction to Principle of Plant Pathology | : | R.S. Singh
Oxford & IBH Publ. Co., New Delhi |
| 3. | Plant Pathology | : | R.S. Mehrotra
Tata McGraw -Hill Publ. Co., New Delhi |
| 4. | The Microbial World and P.R. | : | R.Y. Stanier, J.L. Ingraham, M.L. Wheelis
Painter: Prentice-hall of India, New Delhi. |
| 5. | Test Book of Microbiology | : | R. Ananthanarayan & C.K.J. Paniker
Orient Longman, Bombay |
| 6. | An Introduction to Embryophyta (Bryophyta) | : | N.S. Parihar.
Kitab Mahal, Allahabad |
| 7. | An Introduction to Embryophyta (Pteridophyta) | : | N.S. Parihar.
Kitab, Mahal, Allahabad |
| 8. | Morphology of Pteridophyta | : | K.R. Spome
B.I. Publications, Bombay |
| 9. | Diseases of Crop Plants in India | : | G.Rangaswamy
Prentice Hall of India, New Delhi |
| 10 | Lab Manual of Microbiologist | : | G. Gunasekaran
New age Publication. |

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 cycles of Ginkgo, Taxus and Ephedra.

Fossil algae and fungi. Primitive land plants: Rhynial Lepidodendron, Calamites and Sphenophyllum. Fossil Gymnosperm orders. Cycadofilicales, Bennettitales and Cordaitales. Fossil Angiosperm: Palmoxylon, Enigmocarpon, Sahnianthus: Palaeobotany in the exploration of fossil fuels.

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 affinites and economic importance of the following families: Magnoliaceae, Polygonaceae, Moraceae, Rubiaceae, Apocynaceae, Asclepiadaceae, Acanthaceae, Verbinaceae. Aracaceae, Seitaminae (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 gene pool 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 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 megasporogenesis, Pollen -pistil interacting, compatibility and incompatibility, syngamy and triple fusion. Development, structures and function of endosperm. Types of haustoria, Embryogeny-types, Development of monocot and dicot embryos. Suspensor, synergid, polyembryony, apomixis 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

Recommended Book:

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| 1. | Economic Botany | : | Albert F. Hill
Tata McGraw-Hill Publ. Co., New Delhi |
| 2. | The Embryology of Angiosperms | : | S.S. Bhojwani & S.p. Bhatnagar
Vikas Publ. House Pvt. Ltd. New Delhi. |
| 3. | Palynology | : | M.R. Saxena
Oxford & IBH Publ. Co. Ltd. New Delhi |
| 4. | Morphology of Gymnosperms | : | J.M. Coulter & C.J. Chamberlain
Central Book Depot. Allahabad. |
| 5. | Taxonomy of Vascular Plants | : | G.H.M. Lawrence, Oxford & IBH Publ. Co.,
New Delhi. |
| 6. | A. Handbook of Field and herbarium :
Methods. | : | S.K. Jain & R.R. Rao
Today & Tomorrow's Print & Publ. New Delhi |
| 7. | A Manual of Ethno botany | : | S.K. Jain
Scientific Publications Jodhpur. |
| 8. | Plant Anatomy | : | K. Esau
John Wiley & Sons Inc. New York |
| 9. | An Introduction to Palaeobotany | : | C.A. Arnold.
Tata McGraw-Hill Book Co., New Delhi |
| 10. | The Morphology of Gymnosperms | : | K.R. Sporne
B.I. Publications, Delhi. |
| 11. | An Introduction to the Embryology
of Angiosperms. | : | P. Maheshwari
Tata McGraw-Hill Book Co., New Delhi |
| 12. | The Morphology of Angiosperms | : | K.R. Sporne B.I. Publications, Delhi. |

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| 13. | The Classification of flowering
Plants Volumes I & II | : | Vikas Publ. House Pvt. Ltd. New
Delhi. |
| 14. | Plant Systematic: Theory and
Practical | : | Gurucharan Singh
Oxford & IBH. Publ. Co., New Delhi |
| 15. | Plant Systematics: An Integrated
Approach | : | Gurucharan Singh
Sciences Publ. Inc. USA. |

BOT-507(P)/BOTANY - VII PRACTICAL (Based on theory paper BOT-505 and 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, Sestania).
7. Demonstration of Koch's postulates.
8. Symptoms, causal organisms and microscopic studies of diseased plant specimens theory syllabus.
9. Demonstration of commercial fungicides and equipments for field application.
10. Demonstration studies of thallus and reproductive structures of Riccia, Anthoceros and Polygomon.
11. Demonstration studies of morphological and anatomical structures of Lycopodium. Selaginella and Marchantia 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
Magnoliaceae: Michelia.
Brassicaceae: Brassica/Cardamine
Rutaceae : Citrus.
Fabaceae: Crotalaria/Vigna/Cassia/Caesalpinia/Mimosa/Acacia.
Myraceae: Vallistemon/Eucalyptus.
Anacardiaceae: Mangifera
Cucurbitaceae: Luffa. Rubiaceae: Mussaenda

Apocynaceae: Vinca
 Asclepiadaceae: Calotropis/Asclepius
 Acanthaceae: Justicia/Adhatoda
 Verbinaceae: Duranta/Lantana
 Polygonaceae: Polygonum
 Orchidaceae: Vanda/Dendrobium
 Scitaminae: Musa/Cannal/Maranta/Zingiber
 Arecaceae: Phoenix
 Cyperaceae: Cyprus.

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 condiment and drug. 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/semipermanent 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 slide for 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 garden/herbaria/sanctuaries/research laboratories, etc. and submission of the study report is compulsory.

SEMESTER VI

BOT-608/BOTANY-VIII (Ecology, Plant Physiology and 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.

Unit II: Ecosystems and Pollution: Physical environment; biotic environment; biotic and a biotic interaction, concept of habitat and niche. Ecosystem -basic component of ecosystem. Energy flow in ecosystem, trophic level, Environmental pollution-Major pollutions -air and water and solid, pollution-control measure; Climate change and Global warming - environment revolution. Biodiversity-concept of biodiversity.

Unit III: Plant physiology: Absorption of water, Absorption of mineral elements -roots as absorbing surfaces- passive and active absorption. Physiological role of micro as macro elements-their deficiency symptom. Phase of Growth-growth curve, plant hormones (Auxins, Gibberellins, Cytokinins, Ethylene, Abscissic acid)-Physiological function, senescences, photoperiodism, physiology of flowering photomorphogenesis; phytochromes, physiological role. Photosynthesis- Significance -light reaction, Calvin cycle, photorespiration. Law of limiting factors, chemosynthesis a brief account. Pentose Phosphate Pathway, Biological Nitrogen fixation-mechanisms, elementary knowledge of Nif, Nod, Hup.

Unit IV: Biochemistry: Water as universal solvent- weak interactions in aqueous system, principle 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 organisation in prokaryote and eukaryotes, Operon concept; gene regulation in prokaryotes and eukaryote, 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 technique of gene mapping and concepts of DNA fingerprint; polymerase chain reaction; DNA sequencing. Nucleic Acid: Composition of nucleic Acids DNA structures; A, B and Z forms of DNA; denaturation and renaturation of DNA, chromatin structure; DNA replication and combination; DNA polymerases; different forms of RNA.

Marks: 20

Recommend Books:

1. Fundamental is of Ecology : Odum E.P.
Prentice Hall of India, New Delhi.
2. Concepts of Ecology : Kormondy E.
Prentice Hall of India, New Delhi.
3. Environmental studies : Chary, S.N.
4. Applied Ecology : Newman, E.I.
Blockwell Scientific Publ. London
5. Plant Physiology : Ting I.P.
Addision Wesley Publ. Co., Phillippines.

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| 6. | Plant Physiology | : | Taiz L. & Zeiger E.
Sinauer Associates Inc. Massachusetts |
| 7. | Plant Biochemistry | : | Lehninger A.K. Nelson D.K. & Cox MM
CBS Publ. & Dist. New Delhi. |
| 8. | Biochemistry | : | Lupert Stryer.
Freeman International Edn. USA |
| 9. | Fundamental of Biochemistry | : | Jain J.L.
S.Chand & Co., New Delhi. |
| 10. | Cell and Molecular Biology | : | BI Waverly Pvt. Ltd. |

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 archaeobacteria and mycoplasma. Nucleus and ribosomes; Ultrastructure ; nuclear envelope and nuclear matrix and nucleoplasm; DNA and Histones; nucleosome and higher level of organisation; centromere and telomere. Ribosome structure; prokaryotic, eukaryotic; organelle ribosome and their functional significance.

Mitochondrion and chloroplast; origin, structure and biogenesis; Organelle membrane and organisation of macromolecular complexes; variation in size, shape and number; types of plastids; organelle nuclear interactions organelle gene organisation. Structure and function of Golgi Complex; endoplasmic reticulum lysosomes; 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 transport and signalling. Marks: 20

Unit III: Plant Breeding:

Types of plant reproduction: Vegetative, sexual and apomixes their effect 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 totipotent; 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 organisation programming principles ; programming language; internet and its application; communication tools- word processing, spread sheet and presentation of

software, concept of database, application of Computer in Biological Science introduced to bio statistical analysis of data; Application software for Botany. Bioinformatics - introduction and asses of bioinformatics tolls.

Marks: 20

Recommended Books;

1. Molecular Biology of Cell : Albors. G.B. Bray, D. Lewis J. Raf. M Robert, K. & Naten L.D.
2. Molecular Cell Biology : Garlian Publishing Co, New York
Lodish H. Berk A. Zipursky S.L.
W.H. Freeman & Co., New York.
3. Principles of Genetics : Gardiler E.J. Snustad D.P. &
Simnions S.M.J. John Wiley & Sons,
USA.
4. Plant Tissue Culture: Application & Limitations. : Bhojawni S.S.
Elsevier Science Publishing, New
York
5. Breeding Field Crops : Pachalman, J.m. & Sleeper, D.R.
Longman, London & New York
6. Principle & Practice of Plant Breeding : Sharma R.
Tata McGraw -Hill Publ. Co., New
Delhi
7. Ecology Work Book : Misra R.
Oxford University Press, Calcutta
8. Plant Micro technique : Johansen, D.A.
Tata McGraw -Hill Co. Inc., New
York
9. Chromosome Technique : Sharma, A. & Sharma, A.
(Theory & Practical Butterworths, London
10. Bioinformatics Sequence and Structure Analysis : David Mount
11. Introduction to Bioinformatics : Attwood, T.K. & Parry Smith, D.J.
Pearson Education Asia
12. Bioinformatics to Biological Science and Medicine : Rashidi, H.h. & Buchler, L.K.
CRC Press, London.

BOT-610/BOTANY -X PRACTICAL (Based on theory papers BOT-608 and BOT-609)

Marks: 100

1. Field observation of local vegetable.
2. Study of structure of a plant community by random & 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.
5. Water analysis determination of chlorine dissolved CO_2 in water and measurement of pH).
6. Determination of dissolved by oxygen and biochemical oxygen demand (BOD) in unpolluted and polluted water.
7. Determination of stomata frequently 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 by photosynthesizing leave.
11. Estimation of protein by Bradford method.
12. Paper chromatography separation of amino acids.
13. Measurement of pH of beet, carrot, potato, tuber, Amaranthas 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 stigma/cells hairs.
16. Study of plastids to examine pigment distribution in plants, (e.g. Cassia, Lycopersicum, Capsicum).
17. Examination of electron micrographs of eukaryotic cell with special reference to organelles.
18. Study of various stage of mitosis and meiosis using appropriate plant material (e.g. 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 chromosome maps from 3-points test cross data.
21. Correlation of floral structure with pollination system (e.g. Salvia, Sesamum, Triticum, oriza, Ricinus).
22. Field exploration for detection of male sterile plants and estimation of their pollen for locally grown crops plants e.g. tomato, lemon etc.
23. Estimation of pollen ovule ratios and its bearing on pollination system.
24. Emasculation and bagging of flowers of Brassicaceae, Poaceae, Malvaceae etc.
Pollination them manually and estimating fruits and seed set.
25. Preparation of tissue culture media, sterilization and inoculation of plant materials.
26. Demonstration of technique of in vitro culture of various explants.
27. Isolation of plant protoplasts (e.g. tobacco, petunia) using enzymes available commercially and estimation of their yield.
28. Separation of DNA fragments through gel electrophoresis.
29. Isolation of plasmids for Bacillus/pseudomonas.
30. Hybridization experiments - F_1 and available F_2 material analysis for specific character.
31. Determination of mean, standard deviation using MS EXCEL/SPSS
32. Preparation of presentation of cell organelles using MS PowerPoint or similar packages.
33. Retrieving the Botanical articles from internet.
