

Semester-I

Syllabus for B.Sc. Botany (Major)

2014

(Theoretical)

Paper- BT 101

Full marks-100

Total Lectures – 56 periods
(Each period = 1 hour)

Unit-I: (Fundamental Botany)

(14 Periods)

- 1.1. Origin of life, Difference between plant and animal cell. Time line of plant evolution.
- 1.2. Three domains of classification- Archaea, Bacteria, Eukaryota.
- 1.3. History of Plant classification: Natural (Bentham & Hooker), Artificial (Linnaeus) and Phylogenetic (Hutchinson) system of Classification.
- 1.4. Plant life cycle pattern & alternation of generation.
- 1.5 Darwin's theory of evolution. Macro & micro evolution.
- 1.6. Species concept, Isolation & mechanism of speciation.

Unit-II: (Environmental Botany)

(14 Periods)

- 2.1. Pollution: Definition and categories
- 2.2. Air pollution: Types and sources of air pollutants and their effects on plants and animals.
- 2.3. Water pollution: Types and sources of pollutants and their effects on plants and animals.
- 2.4. Soil pollution: Sources of pollutants and their effects on living organisms.
- 2.5. Bioremediation, noise pollution, acid rain, classical and photochemical smog, heavy metal pollution and radioactive pollution.
- 2.6. Greenhouse effect and global warming- basic concept; significance of ozone umbrella, ozone hole- types of ozone depleting chemicals and their interactions.

Unit-III: Industrial Botany -I (Agri Industries and Microbial fermentation, food & Bio-fuels)

(14 Periods)

- 3.1. Organic farming- Concept, need, types of organic fertilizers, advantages and limitations.
- 3.2. Importance of seed industries. Seed production. Seed processing and marketing. major seed industries & corporation of India.
- 3.3. Production of SCP from algae - *Spirulina* culture technique
- 3.4. Mushroom production and harvesting (*Volvoriella* sp. and *Pleurotus* sp.)
- 3.5. Commercial Production of Ethyl alcohol, Citric acid and Penicillin
- 3.6. Concept of biofuel and its need, Plants used for biofuel production.

Unit-IV: Industrial Botany – II (Plant Nursery and Floriculture Industry) (14 Periods)

- 4.1. Concept and types of nurseries: ornamental plant nursery, fruit plant nursery, medicinal plant nursery, vegetable plant nursery and orchid nursery (with reference to infrastructure required and commercial applications).
- 4.2. Propagation methods: Seed propagation, natural vegetative propagation and artificial vegetative propagation (Cutting: Stem, Layering: Air layering, Grafting: Stone grafting and Approach grafting, Budding: T budding).
- 4.3. Introduction to floriculture: Important floricultural crops, open cultivation practices, harvesting and marketing.

Semester-II
Syllabus for B.Sc. Botany (Major)
2014
(Theoretical)

Paper- BT 201H Full marks-60

Total Lectures - 48 periods
(Each period = 1 Hour)

Unit-I: Algae and Bryophyte

(23 Periods)

1. General account : 1.1 Thallus organization, 1.2 Ultra-structure of plastid & flagella, 1.3 Origin & evolution of sex.
2. Outline classification (Lee-1999) up to phylum with characters.
3. Chlorophyceae- Salient features, Life history : *Chlamydomonas*, *Oedogonium*.
4. Charophyceae- Salient features, Life history : *Chara*.
5. Xanthophyceae- Salient features, Life history-*Vaucheria*.
6. Bacillariophyceae(Diatom) : 6.1 Cell structure, 6.2 Auxospore formation in Centrales and Pennales.
7. Phaeophyceae- Salient features, Life history-*Ectocarpus*.
8. Rhodophyceae- Salient features, Life history-*Polysiphonia*.
9. Economic importance of algae.
10. General account: 10.1 Origin of Bryophytes, 10.2 Amphibian nature, 10.3 Alternation of generation (Homologous and antithetic theory).
11. Life history: Gametophyte structure & reproduction, Development of sporophyte, Spore dispersal of 11.1 *Riccia*, *Marchantia*, 11.2 *Anthoceros*, *Pellia*, 11.3 *Funaria*.
12. Phylogeny : 12.1 Evolution of sporophyte (Progressive and regressive theory).
13. Importance of Bryophyta.

Unit-II: Pteridophyta, Gymnosperm & Palaeobotany (25 Periods)

1. Life history: Sporophyte structure, reproduction and structure of gametophyte of 1.1. *Psilotum*, 1.2. *Selaginella*, 1.3. *Equisetum*, 1.4. *Pteris*, 1.5. *Marsilea*.
2. Fossil Pteridophytes- Structure and features, Geological distribution & evolutionary significance of 2.1. *Rhynia*, 2.2. *Lepidodendron* (reconstructed) 2.3. *Calamites* (reconstructed) 2.4. *Medesmia*.
3. Telome concept & its significance.
4. Heterospory and seed habit.
5. Economic importance as food and medicine.
6. Progymnosperm - 6.1 Diagnostic characters, 6.2 Vegetative & reproductive structures of *Archeopteris*.
7. Life histories- Distribution in India, vegetative and reproductive structure, Development of gametophyte and embryogeny of 7.1. *Cycas*, 7.2. *Pinus*, 7.3. *Gnetum*.
8. Fossil gymnosperms-Structure and features of 8.1 *Lygnopteris*, 8.2 *Williamsonia*, 8.3 *Cordaites*.
9. Economic importance with reference to wood, resins, essential oils & drugs.
10. Plant fossil- 10.1 Types of fossils, 10.2 Different modes of preservation (Schopf-1975), 10.3 Conditions favouring fossilization, 10.4 Importance of fossil study.
11. Geological time scale with dominant plant groups through ages.
12. Indian Gondwana system.

4

Semester-II
Syllabus for B.Sc. Botany (Major)
2014
(Practical)

Paper- B1 202H Full marks-40

1. Work out on algae 8 Marks.
2. Work out on Pteridophytes 8 Marks.
3. Identifications with reasons 2X7=14 Marks.
(Algae-1, Bryophyta-2, Pteridophyta-1, Gymnosperm-2, Paleobotany-1)
4. Laboratory Note book 5 Marks.
5. Viva-voce 5 Marks

PRACTICAL: BT- 202H

I. To learn use of Simple and Compound Microscopes.

II. ALGAE & BRYOPHYTES

1. Work out of the following algae with reproductive structure (Free hand drawing and drawing under drawing prism with magnification): *Oedogonium*, *Chara*, *Ectocarpus*, *Polysiphonia*.
2. Study of Permanent slides: *Volvox*, *Vaucheria*, *Polysiphonia*.
3. Morphological study of the plant body (Bryophytes): Genera as mentioned in theoretical syllabus.
4. Study from permanent slides: *Riccia* (V.S. of thallus with antheridia/archegonia/sporophyte), *Marchantia* (L.S. through gemma cup, antheridiophore, archegoniophore, sporophyte), *Anthoceros* (L.S. of sporophyte), *Funaria* (L.S. of capsule).

III. PTERIDOPHYTES, GYMNOSPERMS & PALAEOBOTANY

1. Morphological study of the sporophytic plant body (Pteridophytes): Genera as mentioned in the theoretical syllabus.
2. Workout of the reproductive structures: *Selaginella*, *Pteris*, *Marsilea*.
3. Study from permanent slides: *Psilotum* (T.S. of synangium), *Lycopodium* (L.S. of strobilus), *Equisetum* (T.S. of stem-internode, L.S. of strobilus).
4. Morphological study: *Cycas* (microsporophyll and megasporophyll), *Pinus* (female and male cone), *Gnetum* (female and male cone).
5. Study from permanent slides: *Cycas* (L.S. of ovule), *Pinus* (L.S. of male and female cone), *Gnetum* (L.S. of male cone and ovule).
6. Study of mega fossils.
7. Study from permanent slides: *Lepidodendron*, *Calamites*, *Lyginopteris*, *Cordaites*, *Glossopteris*.

IV. LABORATORY RECORDS

Laboratory Note Book of each section must be signed by the respective teacher with date during practical classes.

Semester-III
Syllabus for B.Sc. Botany (Major)
(Theoretical)

Paper-BT301H

Full marks-60
(1A-12, E.S.E.-48)
Total Lectures - 30
(Each Lecture-I hr)

Unit I: Fungi and Plant Resource Utilisation

15 Periods

An outline classification of fungi upto class character (Hawksworth-1995). Economic importance of fungi. Lichens and their significance. Fungal spore form, sexual reproduction and degeneration of sex, Mycotoxins; General account of Phycomycetes, Life history of *Mucor*, *Synctitricum*; General account of Ascomycetes, Life history of *Penicillium*, *Ascobolus*; General account of Basidiomycetes, Life history of *Polyporus*, *Agaricus*; General account of Deuteromycetes, Life history of *Fusarium*, Parasexuality.

Cereal- Rice, Wheat; Pulses- Gram, Moong and Lens; Beverages- Tea and Coffee; Fruits- Mango, Citrus and Papaya; Drug yielding- Cinchona, Rauwolfia, Digitalis and Papaver; Spices- Ginger, Cumin and Clove; Oil yielding- Mustard, Groundnut, Coconut and Linseed; Vegetables- Potato, Radish and Cabbage; Fibre yielding- Cotton and Jute; Timber yielding- Teak and Sal; Sugar yielding- Sugarcane and Sugar beet.

Cultivation of Rice, Jute, Rubber and Tea.

Unit II: Microbiology and Plant pathology

15 Periods

General characteristics of Plant virus and Bacteriophage, Growth cycle (Lytic, T₄ and Lysogenic, λ virus); Bacteria-Cell structure and Endospore formation, Genetic recombination-Conjugation, transformation and transduction; Disease concepts, Symptoms- necrotic, hypoplastic and hyperplastic; Necrotrophs and biotrophs, mode of pathogenesis, Defense mechanism with special references to phytoalexins, Plant quarantine; Koch's postulates, Symptoms, Causal organisms, Disease cycle and Control measures of Late blight of potato, Brown spot of rice, Black stem rust of wheat and Stem rot of Jute.

Semester-III
Syllabus for B.Sc. Botany (Major)
2014
(Practical)

Time: 3 hrs

Full marks-40
(IA-08, E.S.E.-32)

- | | |
|---|-------------|
| 1. Work out on fungi (including measurement)..... | 07 |
| 2. Work out on microbiology..... | 07 |
| 3. Identification with reasons..... | (5x2)=10 |
| a) Plant resource utilization..... | 2 specimens |
| b) Plant disease..... | 2 specimens |
| c) Fungi/Microbiology..... | 1 specimen |
| 4. Laboratory note book with submission..... | (3+1)=04 |
| 5. Viva-voce..... | 04 |

Practical – BT302H

1. Work out of the following fungi with reproductive structures (including microscopic measurement of reproductive structures) *Mucor*, *Ascobolus*, *Penicillium*, *Agaricus*, *Puccinia*, *Polyporus*.
2. Study from permanent slides: Zygosporangium of *Mucor*, Conidiophore of *Penicillium*, Conidia of *Fusarium*.
3. Preparation of bacterial media – (a) Nutrient agar and nutrient broth, (b) Preparation of slants and pouring Petriplates.
4. Sub-culturing of bacterial/fungal culture.
5. Microscopic examination of bacteria from natural habitat (curd) by Gram staining.
6. Preparation of fungal media (PDA).
7. Sterilization process.
8. Inoculation of pathogen from diseased leaf.
9. Identification: Pathological specimens of Brown spot of rice, Loose smut of wheat, Stem rot of jute, Late blight of potato; Slides of uredial, telial, pycnial & aecial stages of *Puccinia graminis*.

Semester-IV
Syllabus for B.Sc. Botany (Major)
(Theoretical)

Paper-BT401H,

Full marks-60
(LA-12, E.S.F.-48)
Total Lectures - 28
(Each Lecture-I hr)

Unit I: Morphology and Embryology, Taxonomy

14 Periods

Morphology- Inflorescence- types with examples, flower types, floral parts- calyx, corolla (Forms and aestivation), stamens (cohesion and adhesion), carpel (Apocarpous and Syncarpous), Placentation types, fertilization process; Fruits- types; Taxonomy- Nomenclature and rules of ICBN, Magnoliaceae, Poaceae, Orchidaceae, Mimosaceae, Caesalpiniaceae, Fabaceae, Malvaceae, Brassicaceae, Solanaceae, Apocynaceae, Lamiaceae, Rubiaceae and Asteraceae; Embryology- Micro and mega sporogenesis (Monosporic, bisporic and tetrasporic) Development of embryo, development of endosperm.

Unit II: Anatomy, Ecology and Phytogeography

14 Periods

Anatomy-Cell wall (Gross structure and chemical composition), Meristematic and Permanent tissue (structure, distribution and function); Vascular bundles- types, stele- types and evolution, Normal secondary growth ; Anomalous secondary growth (Stems of *Boerhaavia*, *Chenopodium*, *Mirabilis*, *Bignonia*, *Nyctanthes*, Root of *Tinospora*); Ecology- Habitat and Niche (preliminary idea), Ecological succession- Hydrosere and Xerosere, Endemism, Ecological adaptation - Hydrophytes and xerophytes, Red Data Book; Ecological adaptation of Halophytes; Phytogeography- Phytogeographical regions of India (D. Chatterjee-1960); Vegetation of Western and Eastern Himalaya, Sundarban and Tripura.

Semester-IV
Syllabus for B.Sc. Botany (Major)
2014
(Practical)

Time: 3 hrs

Full marks-40
(1A-08, E.S.E.-32)

1. Work out on Angiosperm.....	08
2. Work out on Anatomy.....	06
3. Spotting (2no.).....	03
4. Identification with reasons(1x4)=04 (Morphology- 1, Ecology- 2, Embryology/Anatomy-1)	
5. Labnotebook and herbarium.....(2+2)=04	
6. Field record.....	03
7. Viva voce.....	04

Practical - BT402H

1. Work out on angiospermic plants- specimens to be selected from the families included in the BT 401 Theory paper.
2. Study of anomalous secondary structures with double staining- *Boerhaavia*, *Bignonia*, *Chenopodium*, *Nyctanthes*, Root of *Tinospora*,
3. Identification
Microscopic study of anatomy: types of stomata, schlerides, types of Raphides, Cystolith, laticiferous duct, Aleurone grain.
4. Identification with reasons:
 - a) Morphology
 - i) Special types of inflorescence
 - ii) Types of stamens
 - iii) Types of Placentation
 - iv) Fruits- types
 - b) Study of adaptive anatomical features- *Nymphaea* petiole, *Nerium* leaf.
 - c) Embryology - Stages of Embryo
5. At least 25 herbarium sheets must be submitted.
6. Students are required to go for at least 2 field study tours.

SEMESTER – V (MAJOR)

BT – 501 (Theory) Marks: 100

Internal Assessment: 20

56 Periods

End Semester Examination: 80

Unit – I: Cell Biology:

14 Periods

Cell cycle and Cell division, equational and reductional division with respect to 'C' value, Cell cycle regulation, Theories of anaphasic movement; Structure and function of Cell Organelles (Nucleus, Mitochondria, Chloroplast, ER, Golgi Apparatus, Peroxisomes and Glyoxysomes, Ultra-structure of ribosome in Prokaryotes and Eukaryotes,) Plasma membrane – Structure (Fluid mosaic model) and function; Chromosome morphology and Organization of eukaryotic Chromosome (Nucleosome concept); Centromere and telomere – structure and function; Organization of cp and mt DNA and their significance; Apoptosis.

Unit – II: Molecular Biology:

14 Periods

Structure, forms and salient features of Nucleic Acids (DNA and RNA); DNA replication - Semi-conservative replication in Prokaryotes with proof (Meselson and Stahl's Experiment), Mechanism of DNA replication in Prokaryotes, Genetic code: Properties, deciphering of genetic code; Transcription: Initiation, elongation and termination in Prokaryotes. Translation in Prokaryotes: Amino-acylation of tRNA, initiation, elongation and termination of polypeptide chain; Gene Mutation: Transition, Transversion and Frame shift mutation, Effects of chemical mutagens (Base analogues and Nitrous acid) Physical agents (UV rays); DNA damage and repair, Concept of Lac Operon (Positive and Negative control).Restriction enzymes: types and function; PCR and its application (A brief idea)

Unit – III: Cytogenetics

14 Periods

Mendelian inheritance; Gene interactions: Incomplete Dominance (1:2:1), Modified dihybrid ratio (12:3:1, 9:3:4, 9:7, 9:6:1, 13:3), Atavism, Pleiotropism; Polygenic inheritance in plant(15:1); Crossing Over: Cytological proof of crossing over (McClintock's experiment); Molecular basis of Crossing Over; Complete and incomplete linkage, Three point test cross, Problems on Gene Mapping; Sex linked trait and sex linked inheritance; Aneuploidy and Euploidy, role of polyploidy in crop improvement; Chromosomal aberration: Types and meiotic behavior of deletion, duplication, translocation and inversion; Molecular mapping- FISH technique; Bioinformatics: Genomics and proteomics (A brief idea).

Unit- IV: Plant Breeding and Biostatistics:

14 Periods

Methods of plant breeding: Introduction, emasculation, Hybridization and Acclimatization; Selection: Mass selection and pure selection; Male sterility: Genetic, Cytoplasmic and Cytoplasmic-genetic male sterility; Heterosis and hybrid vigour; Collection of data (Variable and attribute, Primary and Secondary data, Population and sample); Types of charts and diagrams: Frequency distribution (Simple, Grouped and Cumulative); Measures of Central tendency: Mean Mode and Median; Measure of dispersion: Mean deviation and Standard Deviation; Standard Error; Correlation and Coefficient of Correlation (r); Student t- test; Chi Square test for goodness of fit; Classical definition of Probability, Addition and Multiplication rules.

Semester-V
Practical - Paper 502

End Semester Examination - 80

1. Mitotic Study: Temporary preparation of metaphase chromosomes from root tips of material provided and determination of their somatic chromosome number. 16
2. Study of mitotic index in *Allium cepa* L.

Or

Temporary preparation of meiosis from the supplied material (Any one stage from the suggested practical works) 10

Or

3. Identification with reasons (any three – Identification- 1. Reasons -2) (3X3) = 9
4. Study of pollen sterility by Aceto-carmin staining technique.

Or

Demonstration of emasculation technique 10

5. Statistical analysis of the experimental data as included in the syllabus 15
6. Practical Note Book and Submission of permanent cytological slides (7+3) =10
7. *Viva voce* 10

BT – 601 (Theory) Marks: 100 (Major)

SEMESTER – VI

Internal Assessment: 20

56 Periods

End Semester Examination: 80

Unit- I: Biochemistry

14 Periods

Structure and properties of water, co-valent and non-covalent bonds, hydrogen bonds, Vander Waal's forces, pH, buffer and isoelectric points; Carbohydrate: Classification, structure and properties; Lipids: Classification and function; Protein: Classification and structure (Primary, Secondary, Tertiary and Quaternary structure); Amino acids: Structure, charge and polarity; essential amino-acids; Enzyme: Classification and function, Isozymes, Allosteric enzymes and Coenzymes; Glycolysis, conversion of pyruvic acid to Acetyl Co-A, TCA cycle; Membrane chemistry, transport and mechanism of ion uptake; Signal transduction pathway and second messenger concept- G protein.

Plant physiology:

14 Periods

Water potential and its components; Water absorption by roots (apoplastic and symplastic pathways); Photosynthesis: Components of photosynthesis, Types of chlorophyll and carotenoids and their structures and functions; Red drop effect and Enhancement effect, Antenna complex, photochemical reactions, Mechanism of electron transport in PS-I and PS-II, Calvin cycle; HSK pathway; C_3 and C_4 plants and photosynthetic efficiency, photorespiration, Crassulacean acid metabolism(CAM); Stomatal physiology: role of CO_2 ions, ABA and light, transpiration and anti-transpirant. Respiration: Oxidative Phosphorylation, Mitochondrial ETS and uncouplers, PP pathway; N-metabolism: Assimilation of Nitrogen, Biological Nitrogen fixation: symbiotic fixation; 'nod' genes and 'nif' genes, role of nitrogenase in N_2 fixation; Photoperiodism: Photoperiodic responses and classification of plants, Circadian Clock Photomorphogenesis; Phytochromes as photoreceptor in Photoperiodism, Vernalization, Florigen and transition to flowering; Plant growth regulators, physiological role and modes of action (IAA, Gibberellins and Cyokinins), Brassinosteroids, polyamines.

Unit – III: Pharmacognosy:

14 Periods

Importance of pharmacognosy in modern medicine; Drugs: crude and commercial drugs; Method of commercial drug production, drug adulteration; Classification and evaluation of drugs:

organoleptic, microscopic, chemical and physical evaluation; Secondary metabolites and secondary metabolic biosynthetic pathways; Major types of secondary metabolites with source plants: Flavonoids, steroids, terpenoids, resins, phenolics and alkaloids; Organoleptic study of whole plant of *Andrographis paniculata*, Bark of *Alstonia* sp., Rhizome of Ginger, Tuber of *Dioscoria* sp., Leaves of *Adhatoda* sp.

Unit – IV: Plant Biotechnology

14 Periods

Totipotency and concept of plant tissue culture; Function and organization of a typical plant tissue culture laboratory; Techniques of plant tissue culture: cell suspension culture technique, protoplast culture technique, Meristem tip culture technique; Modes of *in vitro* regeneration and applications; *In vitro* exudation and remedial Measures; Callus culture and applications; Haploid and embryo culture; Prokaryotic vector system and marker genes; Transformation: *Agrobacterium* mediated gene transfer, Particle Bombardment method.

Practical BT-602 (H)

Full marks-100

Internal Assessment: 20

End Semester Examination: 80

SECTION : A

1. Detection of organic acids: citric, tartaric, oxalic and malic acids from unknown samples.
2. Detection of the nature of carbohydrate: glucose, fructose, sucrose and starch from unknown samples.
3. Detection of Ca, Mg, Fe and S from plant ash sample.
4. Estimation of acidity from lemon by titration method.
5. Colorimetric estimation of protein by Folin phenol reagent.

SECTION: B

6. Estimation of Catalase activity in plant samples.
7. Effect of CO₂ on the rate of photosynthesis.
8. To extract and separate chlorophyll pigment by chromatogram.
9. Determination of loss of water per stomata per hour.
10. Relationship between transpiration and evaporation.
11. Measurement of oxygen uptake by respiring tissue (per g/hr).
12. Determination of the RQ of germinating seeds.
13. Measurement of osmotic pressure of *Rhoeo* leaf by plasmolytic method.
14. Effect of temperature on absorption of water by storage tissue and determination of Q₁₀.
15. Comparison of imbibitions of water by starchy, proteinaceous and fatty seeds.

SECTION : C

16. Study of Palisade ratio and Vein islet no.
17. Chemical tests for Steroids and Alkaloids.
18. Powder microscopy of the plant samples as per contents of the syllabus.

SECTION: D

19. Demonstration and function of autoclave, laminar airflow, pH meter and culture room.
20. Aseptic techniques of explants culture.

Laboratory records:

1. Laboratory note book of each section must be signed by the respective teacher with date during practical classes.

Practical BT-602

Full marks-100

End Semester Examination: 80

1. Experiment on biochemical works as per practical workout (A)	14
2. To perform a major physiological experiment from the list of the experiments as per contents of practical syllabus (B)	22
3. Work out on pharmacognosy (C)	12
4. Demonstration on Plant tissue culture technique (D)	12
5. Practical Note Book	10
6. <i>Viva voce</i>	10