

**UNIVERSITY OF CALCUTTA**  
**Sagar Mahavidyalaya**

**SYLLABUS**  
**FOR**  
**THREE-YEAR B.Sc. PROGRAMME IN**  
**BOTANY (GENERAL COURSE)**

**UNDER CHOICE BASED CREDIT SYSTEM**

**BOTANY**

**Syllabus for three-year B.Sc. Botany Programme**  
**(With effect from 2018-2019)**

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**SEMESTER I**  
**CORE COURSE 1 PLANT DIVERSITY I (PHYCOLOGY, MYCOLOGY, PHYTOPATHOLOGY, BRYOPHYTES AND ANATOMY)**  
**(BOT-G-CC-1-1-TH) THEORETICAL (Credits 4, Lectures 60)**

1. Introduction to different plant groups .....2 lectures
  2. Phycology 2.1. Diagnostic characters and examples of Cyanophyceae, Rhodophyceae, Chlorophyceae, Charophyceae and Phaeophyceae, 2.2 Classification: Criteria and system of Fritsch, 2.3. Life histories of Chlamydomonas, Chara and Ectocarpus, 2.4. Role of algae in the environment, agriculture, biotechnology and industry. ....14 lectures
  3. Mycology 3.1 Diagnostic characters and examples of Oomycotina, Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina (Ainsworth, 1973). 3.2 Life histories of Rhizopus and Ascobolus, 3.3. Economic importance of fungi, 3.4 Fungal symbioses: Mycorrhiza, Lichen and their importance. ....12 lectures
  4. Phytopathology 4.1 Symptoms - necrotic, hypoplastic and hyperplastic, 4.2 Koch's postulates, 4.3 Biotrophs and Necrotrophs, 4.4 Disease triangle, 4.5 Pathotoxins and phytoalexins (brief concept), 4.6 Symptoms, causal organism, disease cycle and control measures of plant diseases (Late blight of potato, Brown spot of Rice, Stem rot of jute). ....10 lectures
  5. Bryophytes 5.1 Unifying features of archaegoniates and transition to land habit, 5.2 Amphibian nature of bryophytes, 5.3 Diagnostic characters and examples of Hepaticopsida, Anthocerotopsida and Bryopsida (Proskauer 1957), 5.4 Life histories of Marchantia and Funaria, 5.5 Ecological and economic importance. ....10 lectures
  6. Anatomy 6.1 Stomata - Types (Metcalf & Chalk), 6.2 Anatomy of root, stem and leaf of monocots and dicots, 6.3 Stelar types and evolution, 6.4 Secondary growth – normal in dicot stem and anomaly in stem of Tecoma & Dracaena. ....12 lectures
- 5 PRACTICAL- PLANT DIVERSITY I (PHYCOLOGY, MYCOLOGY, PHYTOPATHOLOGY, BRYOPHYTES AND ANATOMY) (BOT-G-CC-1-1-P) (Credits 2)**
1. Work out: Microscopic preparation, drawing and labeling of Chlamydomonas, Chara, Ectocarpus, Rhizopus and Ascobolus
  2. Anatomical studies (following double staining method) of: 2a. Stem- Cucurbita, sunflower and maize. 2b. Root- Colocassia, gram and orchid. 2c. Leaf- Nerium
  3. Identification with reasons: 3a. Cryptogamic specimens (macroscopic/microscopic as prescribed in the theoretical syllabus. 3b. Pathological specimens (herbarium sheets) of Late blight of potato, Brown spot of rice and stem rot of jute.
  4. Laboratory records: Laboratory note books (regularly signed) and slides (prepared in class) are to be submitted at the time of Practical Examination. Regular attendance in the class must be credited.
  5. Atleast one local excursion to be conducted to give an idea of plant diversity, habitat of algae and fungi

**SEMESTER II**  
**CORE COURSE 2 PLANT DIVERSITY II (PTERIDOPHYTES, GYMNOSPERMS, PALAEOBOTANY, MORPHOLOGY AND TAXONOMY)**  
**(BOT-G-CC-2-2-TH) THEORETICAL (Credits 4, Lectures 60)**

1. Pteridophytes 1.1 Diagnostic characters and examples of Psilophyta, Lycophyta, Sphenophyta & Filicophyta (Gifford & Foster 1989). 1.2 Life histories of Selaginella and Pteris, 1.3 Economic importance. ....12 lectures
2. Gymnosperms 2.1 Progymnosperms (brief idea), 2.2 Diagnostic characters and examples of Cycadophyta, Coniferophyta and Gnetophyta (Gifford & Foster 1989), 2.3 Life histories of Cycas and Pinus, 2.4 Williamsonia (reconstructed), 2.5 Economic importance of Gymnosperms. ....12 lectures
3. Paleobotany & Palynology 3.1 Fossil, fossilization process and factors of fossilization, 3.2 Importance of fossil study. 3.3 Geological time scale, 3.4 Palynology - Definition, spore & pollen (brief idea), Applications. ....10 lectures
4. Angiosperm Morphology 4.1 Inflorescence types with examples, 4.2 Flower, 4.3 Fruits and seeds- type and examples. ....12 lectures
5. Taxonomy of Angiosperms 5.1 Artificial, Natural and Phylogenetic systems of classification with one example each, 5.2 Diagnostic features of following families- Malvaceae, Leguminosae (Fabaceae), Cucurbitaceae, 6 Rubiaceae, Compositae (Asteraceae), Solanaceae, Acanthaceae, Labiatae (Lamiaceae), Orchidaceae, Gramineae (Poaceae). ....14 lectures

**PRACTICAL-**  
**PLANT DIVERSITY II (PTERIDOPHYTES, GYMNOSPERMS, PALAEOBOTANY, MORPHOLOGY AND TAXONOMY) (BOT-G-CC-2-2-P) (Credits 2)**

1. Dissection, drawing and labelling, description of angiospermic plants and floral parts, floral formula and floral diagram, identification (family) from the following families: Leguminosae (Fabaceae), Malvaceae, Solanaceae, Labiatea (Lamiaceae), Acanthaceae. 2. Identification with reasons: Macroscopic specimens of Selaginella and Pteris, male and female strobilus of Cycas and Pinus, Anatomical slides (stellar types, transfusion tissue, sieve tube, sunken stomata, lenticels), inflorescence types. 3. Spot identification of the following Angiospermic plants (scientific names and families): Sida rhombifolia (Malvaceae), Abutilon indicum (Malvaceae), Cassia sophera (Fabaceae), Tephrosia halimtonii (Fabaceae), Crotolaria palida (Fabaceae), Coccinia grandis (Cucurbitaceae), Solanum indicum (Solanaceae), Nicotiana plumbagenifolia (Solanaceae), Leucas aspera (Lamiaceae), Leonurus sibiricus (Lamiaceae), Parthenium hysterophorus (Asteraceae), Tridax procumbense (Asteraceae), Eclipta prostrate (Asteraceae), Eragrostis tenella (Poaceae), Chrysopogon aciculatus (Poaceae), Eleusine indica (Poaceae), Vanda taesellata (Orchidaceae). 4. Laboratory records: Laboratory note books (regularly signed) and slides (prepared in class) are to be submitted at the time of Practical Examination. Regular attendance in the class must be credited. 5. Field excursion: Local Excursions (at least two including one to Acharya Jagadish Chandra Bose Botanic Garden, Shibpur, Howrah) 6. Field Records: Field note book and 15 herbarium sheets of common Angiospermic weeds are to be prepared and submitted at the time of Practical Examination. Regular attendance in the class must be credited.

**SEMESTER III**  
**CORE COURSE 3**  
**CELL BIOLOGY, GENETICS AND MICROBIOLOGY (BOT-G-CC-3-3-TH) THEORETICAL (Credits 4, Lectures 60)**

1. Cell Biology and Genetics 1.1 Ultrastructure of nuclear envelope, nucleolus and their functions, 1.2 Molecular organisation of metaphase chromosome (Nucleosome concept). 7 .....6 lectures 2. Chromosomal aberrations- 2.1 deletion, duplication, inversion & translocation, 2.2 Aneuploidy & Polyploidy-types, importance and role in evolution. ....6 lectures 3. Central Dogma, 3.1 Transcription and Translation. ....10 lectures 4. Genetic Code- properties. ....4 lectures 5. Linkage group and Genetic map (three-point test cross). ....6 lectures 6. Mutation – 6.1 Point mutation (tautomerisation; transition, transversion and frame shift), 6.2 Mutagen-physical and chemical. ....8 lectures 7. Brief concept of Split gene, Transposons. ....4 lectures 2. Microbes 2.1 Viruses- Discovery, general structure, replication (general account), DNA virus (T-phage); Lytic and lysogenic cycle, RNA virus (TMV); Economic importance; 2.2 Bacteria- discovery, general characteristics and cell structure; reproduction- vegetative, asexual and recombination (conjugation, transformation and transduction); Economic importance. .... 16 lectures

**PRACTICAL-**  
**CELL BIOLOGY, GENETICS AND MICROBIOLOGY (BOT-G-CC-3-3-P) (Credits 2)**

1. Cell Biology: Staining (Aceto-orcein) and squash preparation of onion root tip: study of mitotic stages. Determination of mitotic index (from onion root tip). 2. Microbiology: Workout gram staining (curd/any natural source) 3. Identification with reasons: Cytological slides of different mitotic and meiotic stages. Different forms of bacteria (Coccus, Bacillus, Spiral) 4. Laboratory Records: Laboratory note books (regularly

signed) and slides (prepared in class) are to be submitted at the time of Practical Examination. Regular attendance in the class must be credited 8

**SEMESTER IV**  
**CORE COURSE 4 PLANT PHYSIOLOGY AND METABOLISM (BOT-G-CC-4-4-TH)**

**THEORETICAL (Credits 4, Lectures 60)**

1. Proteins 1.1 Primary, secondary and tertiary structure, 1.2 Nucleic acid- DNA structure, RNA types, 1.3 Enzyme- Classifications with examples (IUBMB), Mechanism of action. ....8 lectures 2. Transport in plants 2.1 Ascent of sap and Xylem cavitation , 2.2 Phloem transport and source-sink relation. ....4 lectures 3. Transpiration 3.1 Mechanism of stomatal movement, significance. ....4 lectures 4. Photosynthesis 4.1 Pigments, Action spectra and Enhancement effect, 4.2 Electron transport system and Photophosphorylation, 4.3 C<sub>3</sub> and C<sub>4</sub> photosynthesis, CAM- Reaction and Significance. ....12 lectures 5. Respiration 5.1 Glycolysis & Krebs cycle— Reactions and Significance, 5.2 ETS and oxidative phosphorylation. ....8 lectures 6. Nitrogen metabolism 6.1 Biological dinitrogen fixation, 6.2 Amino acid synthesis (reductive amination and transamination). ....6 lectures 7. Plant Growth regulators 7.1 Physiological roles of Auxin, Gibberellin, Cytokinin, Ethylene, ABA. ....10 lectures 8. Photoperiodism (Plant types, Role of phytochrome and GA in flowering) and Vernalization. ....6 lectures 9. Senescence (brief idea). ....2 lectures

**PRACTICAL-**

**PLANT PHYSIOLOGY AND METABOLISM**  
**(BOT-G-CC-4-4-P) (Credits 2)**

Plant Physiology: i) Experiment on Plasmolysis.

ii) Measurement of leaf area (graphical method) and determination of transpiration rate per unit area by weighing method.

iii) Imbibition of water by dry seeds - proteinaceous and fatty seeds

iv) Evolution of O<sub>2</sub> during photosynthesis (using graduated tube).

v) Evolution of CO<sub>2</sub> during aerobic respiration and measurement of volume.

**SEC A PLANT BREEDING AND BIOMETRY**  
**(BOT-G-SEC-A-3/5-1) (Credits 2, Lectures 30)**

1. Plant breeding: 1.1 Introduction and objective, 1.2 Techniques of hybridisation. ....2 lectures 2. Mass and Pure line selection: 2.1 Procedure, 2.2 Advantages and limitations. ....8 lectures 3. Heterosis and hybrid seed production. ....4 lectures 4. Role of mutation, polyploidy, distant hybridization and role of biotechnology in crop improvement. ....8 lectures 5. Biometry: 5.1 Measures of central tendency (Mean, Median and Mode), 5.2 Standard error and standard deviation, 5.3 Test of significance: Chi-square test for goodness of fit. ....8 lectures

**BIOFERTILIZERS**  
**(BOT-G-SEC-A-3/5-2) (Credits 2, Lectures 30)**

1. Biofertilizers: General account about microbes used as biofertilisers; Rhizobium identification, mass multiplication. Actinorrhizal symbiosis. ....4 lectures 2. Azospirillum- identification, mass multiplication,

associative effect of different microorganisms. Azotobacter and crop response to Azotobacter inoculums. ....6 lectures 3. Cyanobacteria, Azolla, Anabaena and Azolla association, blue green algae and Azolla in rice cultivation. ....6 lectures 4. Mycorrhizal association: 4.1 Types of Mycorrhizal association- Brief idea, 4.2 Its influence on growth and yield of crop plants. 10 ....6 lectures 5. Organic farming: 5.1 Green manuring and organic fertilizers, 5.2 Biocompost and vermicompost- making methods and field applications. 5.3 Recycling of biodegradable municipal, industrial and agricultural wastes. ....8 lectures

## **SEC B**

### **PLANT BIOTECHNOLOGY**

#### **(BOT-G-SEC-B-4/6-3) (Credits 2, Lectures 30)**

1. Plant tissue culture- 1.1 Introduction and basic concepts, 1.2 Cellular potency, 1.3 Callus culture and plant regeneration. ....4 lectures 2. Micropropagation- 2.1 Somatic embryogenesis and artificial seed. ....4 lectures 3. Protoplast culture and its application. ....6 lectures 4. Recombinant DNA technology- 4.1 Recombinant DNA, 4.2 Restriction enzymes, 4.3 Plasmids as vectors. ....8 lectures 5. Gene cloning (basic steps). ....4 lectures 6. Achievements in crop biotechnology- 6.1 Pest resistant plant (Bt cotton), 6.2 Transgenic crops with improved quality (flavr tomato and golden rice). ....4 lectures

### **MUSHROOM CULTURE TECHNOLOGY**

#### **(BOT-G-SEC-D-4/6-4) (Credits 2, Lectures 30)**

1. Mushroom- nutritional and medicinal value of mushrooms. Poisonous mushrooms. ....4 lectures 2. Cultivation techniques/ technology of edible mushrooms in India: Volvarealla volvacea, Pleuretus citrinopyrineatus, Agaricus bisporus. ....12 lectures 3. Storage- short term and long term, storage, drying. ....6 lectures 4. Food preparation- types of foods prepared from mushroom. Cost and benefit ratio. ....6 lectures 5. Research centres- national and regional. ....2 lectures 11

## **DSE A**

### **(Group A) PHYTOCHEMISTRY AND MEDICINAL BOTANY**

#### **(BOT-G-DSE-A-5-1-TH) THEORETICAL (Credit 4, Lectures 60)**

1. Medicinal botany- History, scope and importance of medicinal plants, a broef idea about indigenous medicinal sciences- Ayurveda, Siddha and Unani. Polyherbal formulations. ....14 lectures 2. Phramacognosy- 2.1 Scope and its importance, 2.2 Primary metabolites, 2.3 Secondary metabolites- alkaloids, terpenoids, phenolics and their functions. ....10 lectures 3. Organoleptic evaluation of crude drugs. ....10 lectures 4. Pharmacologically active constituents: Source plants (one example), parts used and uses of: 4.1 Steroids (Diosgenin, Digitoxin), 4.2 Tannin (Catechin), 4.3 Resins (Gingerol, Curcumnoids), 4.4 Alkaloids (Strychnine, Reserpine, Vinblastine), 4.5 Phenols (Capsaicin). ....6 lectures 5. Ethnobotany and folk medicine: 5.1 Brief idea, 5.2 Applications of ethnobotany, 5.3 Application of natural product to certain diseases- Jaundice, Cardiac and Diabetics. ....20 lectures

## **PRACTICAL-**

### **PHYTOCHEMISTRY AND MEDICINAL BOTANY**

#### **(BOT-G-DSE-A-5-1-P) (Credit 2)**

1. Preparations of solution and buffers
2. Acquaintance with laboratory instruments- Autoclave, Incubator, Clinical centrifuge, Analytical balance, pH meter, Colorimeter, Water bath, Distillation plant, Laminar air flow.

3. Qualitative test for proteins and carbohydrates, reducing and non reducing sugar (glucose, fructose and sucrose)
4. Tests (chemical) for tannin and alkaloid
5. Identification of medicinal plants (list to be provided)
6. Field study (local) and listing of medicinal plants. Records to be substantiated with photographs and description. 12

**NATURAL RESOURCE MANagements**  
**(BOT-G-DSE-A-5-2-TH)**

**THEORETICAL (Credits 4, Lectures 60)**

1. Natural resources- definition and types. ....2 lectures
2. Sustainable utilization- concept, approaches (economic, ecological and socio-cultural). ....10 lectures
3. Land utilization. Soil degradation and management. ....8 lectures
4. Water, fresh water marine, estuarine. Wetlands- threats and management. ....10 lectures
5. Biological resources, biodiversity- definition and types. Significance, threats and management strategies. ....10 lectures
6. Forests- definition, cover and its significance (with special reference to India). Major and minor forest products. ....8 lectures
7. Energy- renewable and non-renewable source of energy. ....8 lectures
8. EIA and waste management. ....4 lectures

**PRACTICAL-**

**NATURAL RESOURCE MANagements**  
**(BOT-G-DSE-A-5-2-P) (Credits 2)**

1. Estimation of solid waste generated by a domestic system (biodegradable and nonbiodegradable) and its impact on land degradation. 2. Measurement of dominant woody species by DBH (diameter at breast height) 3. Study of community structure by Quadrat method and determination of minimal size of quadrat, frequency density and abundance of components to be done during field visit. 4. Measurement of dissolved O<sub>2</sub> by azide modification of Winkler's method. 5. Determination of chemical properties of soil by rapid spot test (carbonate, iron, nitrate) 13

**DSE B**

**ECONOMIC BOTANY**  
**(BOT-G-DSE-B-6-3-TH)**

**THEORETICAL (Credits 4, Lectures 60)**

1. Origin of cultivated plants: 1.1 Concepts of centres of origin and their importance with reference to Vavilov's work. ....12 lectures
2. Rice- origin, morphology and uses. ....12 lectures
3. Legumes: General account with special reference to Vigna. ....8 lectures
4. Beverages: Tea- morphology, processing and uses. ....12 lectures
5. Study of the following economically important plants (Scientific names, families, parts used and importance): 5.1 Cereals- Rice, wheat, 5.2 Pulses- Mong, gram, 5.3 Spices- Ginger, cumin, 5.4 Beverages- Tea, coffee, 5.5 Medicinal plants- Cinchona, neem, Ipecac, Vasaka, 5.6 Oil yielding plants- Mustard, groundnut, coconut, 5.7 Vegetables- Potato, radish, bottle gourd, cabbage, 5.8 Fibre yielding plants- Cotton, jute, 5.9 Timber yielding plants- Teak, Sal 5.10 Fruits- Mango, apple, 5.11 Sugar yielding plant- Sugarcane. ....16 lectures

**PRACTICAL-**

**ECONOMIC BOTANY (BOT-G-DSE-B-6-3-P) (Credits 2)**

1. Study of economically important plants (rice/jute/ tea) through herbarium specimens and field study. 2. Study of cultivation practices in field and submission of report. 3. Study of local economically important plants and submission of report with photographs.

**HORTICULTURAL PRACTICES AND POST HARVEST TECHNOLOGY**  
**(BOT-G-DSE-B-6-4-TH)**

**THEORETICAL (Credits 4, Lectures 60)**

1. Horticulture- role in rural economy and employment generation. Urban horticulture- its scope and importance. ....6 lectures  
2. Ornamental plants- identification and salient features of some ornamental plants (rose, marigold, gladiolus, gerberas, tube rose, carnations, cacti and succulents). Ornamental flowering trees (Gulmohor, Lagerstromia, Shimul, Coral tree and jacaranda). 14 .....12 lectures  
3. Identification of some fruits and vegetable plants- Citrus, Banana, Papaya, Mango, Jackfruit, Chillies and cucurbits. Fruit processing- scope and benefits. ....10 lectures  
4. Horticultural techniques- propagation methods, application of manure, fertilizers, nutrients and PGR. Weed control. Biofertilizers and biopesticides. ....12 lectures  
5. Post harvest technology- importance of post harvest technology in horticultural practices. Harvesting and handling of fruits, vegetables and cut flower. Methods of preservation and processing. ....10 lectures  
6. Disease control and management- field and post harvest diseases of common crops. Crop sanitation, quarantine practices. Identification of common diseases and pest of fruits and vegetable crops. ....10 lectures  
**PRACTICAL- HORTICULTURAL PRACTICES AND POST HARVEST TECHNOLOGY (BOT-G-DSE-B-6-4-P) (Credits 2)**  
1. Field trips to gardens, standing crop sites, nurseries, vegetable gardens, horticultural fields and cold storages. 15 R