

**UNIVERSITY OF CALCUTTA**  
**SYLLABUS**  
**FOR**  
**THREE-YEAR B.Sc. GENERAL COURSE**  
**UNDER 1+1+1 SYSTEM**  
**OF EXAMINATION**



**BOTANY 2010**

**Syllabus for three-year B.Sc. Botany General Course**  
**(With effect from 2010-2011)**

**PART-I : Full Marks-100**

**Paper-I (Theoretical)****Marks-100****Module I:**

[50 marks]

Microbiology, Algae, Fungi, Plant Pathology, Bryophytes.

**Module II:**

[50 marks]

Pteridophytes, Gymnosperms, Palaeobotany &amp; Palynology, Angiosperms (Morphology &amp; Embryology), Taxonomy.

**PART II : Full Marks-200  
(Theoretical-100 & Practical-100)****Paper-II (Theoretical)****Marks-100****Module III:**

50 Marks

Anatomy, Cell Biology and Genetics.

**Module IV:**

50 marks

Biochemistry and Plant Physiology, Economic Botany, Ecology.

**PAPER-III (Practical)****Full Marks-100**

(Each module to be conducted on separate days)

**Module V****4 Hours: Marks 50**

- |   |    |
|---|----|
| 1. Work out on Algae/Fungi (anyone)   | 9  |
| 2. Work out on Angiosperms  | 12 |
| 3. Identification: (2 x 7)<br>Algae/Fungi-1, Bryophyte-1, Pteridophyte-1, Gymnosperm-1,<br>Morphology-1, Taxonomy-2 (species and family). | 14 |
| 4. Submission: Laboratory records (laboratory note-book, slides) and Field records (field note book, herbarium sheets). (5+5) =           | 10 |
| 5. Viva-voce  | 5  |

**Module VI****4 Hours: Marks 50**

1. Plant Physiology Experiment	12
2. Anatomy	12
3. Cell Biology	10
4. Identification: (3x2)    Anatomy-1, Cytology-1	6
5. Submission: Laboratory records	5
5. Viva-voce	5

**PART III : Full Marks-100  
(Theoretical-70 & Practical-30)**

**Paper-IVA (Theoretical) 3 Hours: Marks 70**

**Module VII Marks- 70**

Biofertilizer, Mushroom, Plant Disease Control, Plant Breeding, Biometry, Plant Tissue Culture, Recombinant DNA Technology, Pharmacognosy

**PAPER - IVB (Practical) Marks-30**

**Module VIII 3 Hours: Marks-30**

1. Microbiology	5
2. Biometry	8
3. Demonstration of a laboratory instrument	4
4. Identification of medicinal plants (2 x 2)	4
5. Submission (Laboratory note book & Field report)	4
6. Viva-voce	5

# Syllabus for three-year B.Sc. Botany General Course (With effect from 2010-2011)

## **PART-I** **Full Marks-100**

### Paper-I (Theoretical)

Marks-100

#### Module I:

[50 marks]

Microbiology, Algae, Fungi, Plant Pathology, Bryophytes.

#### Module II:

[50 marks]

Pteridophytes, Gymnosperms, Palaeobotany & Palynology, Angiosperms  
(Morphology & Embryology), Taxonomy.

### Module I:

50 Marks

- 1. Domains of life:** Archaea, Bacteria and Eukarya.
- 2. Microbiology:**
  - 2.1 Plant virus - general characteristics, 2.2 Transmission and Translocation of plant virus, 2.3 Lytic cycle (T4 phase) and Lysogenic cycle (Lambda phage), 2.4 Chemical nature of cell wall of Gram positive and Gram negative bacteria, 2.5 Genetic recombination in bacteria (Conjugation, Transformation, Transduction), 2.6 Industrial uses of bacteria.
- 3. Algae:**
  - 3.1. Diagnostic characters and examples of Cyanophyceae, Rhodophyceae, Chlorophyceae, Charophyceae and Phaeophyceae (Lee 1999), 3.2 Life histories of *Chara* and *Ectocarpus*, 3.3 Economic importance.
- 4. Fungi:**
  - 4.1 Diagnostic characters and examples of Oomycotina, Mastigomycotina, Zygomycotina, Ascomycotina Basidiomycotina, Deuteromycotina (Ainsworth, 1973). 4.2 Life histories of *Rhizopus* and *Ascobolus*: 4.3. Economic importance of fungi, 4.4 Fungal symbioses: Mycorrhiza, Lichen and their importance.
- 5. Plant Pathology :**
  - 5.1 Symptoms - necrotic, hypoplastic and hyperplastic, 5.2 Koch's postulates, 5.3 Biotrophs and Necrotrophs, 5.4 Disease triangle, 5.5 Pathotoxins and phytoalexins (brief concept), 5.6 Symptoms, causal organism, disease cycle and control measures of plant diseases (Late blight of potato, Black steam rust of wheat).
- 6. Bryophytes:**
  - 6.1 Amphibian nature, 6.2 Diagnostic characters and examples of Hepaticopsida, Anthocerotopsida and Bryopsida (Proskauer 1957), 6.3 Life histories of *Marchantia* and *Funaria*. 6.4 Ecological importance.

**Module II:****50 Marks****7. Pteridophytes:**

7.1 Diagnostic characters and examples of Psilophyta, Lycophyta, Sphenophyta & Filicophyta (Gifford & Foster 1989), 7.2 Life histories of *Selaginella* and *Dryopteris*. 7.3 Economic importance.

**8. Gymnosperms:**

8.1 Progymnosperms (brief idea), 8.2 Diagnostic characters and examples of Cycadophyta, Coniferophyta and Gnetales (Gifford & Foster 1989), 8.3 Life histories of *Cycas* and *Pinus*. 8.4 Economic importance of Gymnosperms.

**9. Paleobotany & Palynology:**

9.1 Importance of fossil study, 9.2 Modes of Preservation. 9.3 Geological time scale. 9.4 *Williamsonia* (Reconstructed), 9.5 Palynology - Definition, spore & pollen (brief idea), Applications.

**10. Angiosperm Morphology & Embryology:**

10.1 Inflorescence types with examples, 10.2 Corolla forms, aestivation, 10.3 Placentation types, 10.4 Sporogenesis & Gametogenesis, 10.5 Embryo development in *Capsella*, 10.6 Endosperm development.

**11. Taxonomy of Angiosperms :**

11.1 Artificial, Natural and Phylogenetic systems of classification, 11.2 Principles of ICBN, 11.3 Bentham and Hooker's system of classification, 11.4 Phenetics- Brief concept. 11.5 Diagnostic features of following families- Malvaceae, Leguminosae (Fabaceae), Cucurbitaceae, Solanaceae, Labiales (Lamiaceae), Acanthaceae, Rubiaceae, Compositae (Asteraceae), Gramineae (Poaceae), Orchidaceae.

**PART II**  
**Full Marks-200**  
**(Theoretical-100 & Practical-100)**

**Paper-II (Theoretical)****Marks-100****Module III:****50 Marks**

Anatomy, Cell Biology and Genetics.

**Module IV:****50 marks**

Biochemistry and Plant Physiology, Economic Botany, Ecology.

**Module III:****50 Marks****1. Anatomy:**

1.1 Stomata - Types (Metcalfe & Chalk), 1.2 Mechanical Tissues - Principle and distribution, 1.3 Stellar types and evolution, 1.4 Shoot apex (Tunica-Corpus) and Root apex

(Körper-Kappe), 1.5 Secondary growth – normal in dicot stem and anomaly in stem of *Tecoma & Dracaena*.

## 2. Cell Biology and Genetics:

2.1 Ultrastructure of nuclear envelope, nucleolus and their functions, 2.2 Molecular organisation of metaphase chromosome (Nucleosome concept), 2.3 Chromosomal aberrations- deletion, duplication, inversion & translocation, 2.4 Aneuploidy & Polyploidy-types, importance and role in evolution, 2.5 Central Dogma, 2.6 DNA replication -mechanism in prokaryote, 2.7 Transcription, Processing of mRNA and Translation, 2.8 Genetic Code-properties, 2.9 Epistasis, 2.10 Linkage group and Genetic map (three-point test cross), 2.11 Mutation - Point mutation (tautomerisation; transition, transversion and frame shift), Mutagen-physical and chemical, 2.12 Brief concept of Split gene, Transposons.

## Module IV

Marks: 50

## 3. Biochemistry and Plant Physiology:

3.1 Proteins - Primary, secondary and tertiary structure, 3.2 Nucleic acid- DNA structure, RNA types, 3.3 Enzyme- Classifications with examples (IUBMB), Mechanism of action. 3.4 Transport in plants - ascent of sap and Xylem cavitation, Phloem transport and source-sink relation, 3.5 Transpiration- Mechanism of stomatal movement, significance 3.6 Photosynthesis- Pigments, Action spectra and Enhancement effect, Electron transport system and Photophosphorylation, C<sub>3</sub> and C<sub>4</sub> photosynthesis, CAM- Reaction and Significance 3.7 Respiration- Glycolysis & Krebs cycle— Reactions and Significance, ETS and oxidative phosphorylation 3.8 Nitrogen metabolism –Biological dinitrogen fixation, Amino acid synthesis (reductive amination and transamination) 3.9 Plant Growth regulators – Physiological roles of Auxin, Gibberellin, Cytokinin, Ethylene, ABA 3.10 Photoperiodism (Plant types, Role of phytochrome and GA in flowering) and Vernalization 3.11 Senescence (brief idea).

## 4. Economic Botany:

Study of the following economically important plants (scientific names, families, parts used and importance) : 4.1 Cereals-rice, wheat, 4.2 Pulses- mung, gram, 4.3 Spices - ginger, cumin, 4.4 Beverages - tea, coffee, 4.5 Medicinal Plants - cinchona, neem, ipecac, vasaka, 4.6 Oil yielding plants- mustard, groundnut, coconut, 4.7 Vegetables-potato, radish, bottlegourd, cabbage, 4.8 Fibre yielding plants-cotton, jute, 4.9 Timber yielding plants-teak, sal 4.10 Fruits- mango, apple, 4.11 Sugar yielding plant- sugarcane.

## 5. Ecology:

5.1 Ecotypes and microclimate, 5.2 Plant succession - stages of succession (hydrosere) 5.3 Ecological adaptation of hydrophytes, halophytes and xerophytes, 5.4 Biodiversity - Definition, levels of biodiversity (genetic, species and ecosystem), methods of *in-situ* & *ex-situ* conservation, 5.5 Phytoremediation (brief idea).

## Paper-III (Practical)

Marks-100

## Module V

50 Marks

1. **Cryptogams:** Work out, microscopic preparation, drawing and labeling, description and identification of the following cryptogams: *Chara*, *Ectocarpus*, *Rhizopus*, *Ascobolus*.
2. **Angiosperms:** Dissection, drawing and labeling, description of angiospermic plants and floral parts, floral formula and floral diagram, identification (family) from the following families: Leguminosae (Fabaceae), Malvaceae, Solanaceae, Labiales (Lamiaceae), Acanthaceae.
3. **Identification with reasons:**  
Cryptogamic specimens (macroscopic/microscopic) as prescribed in the theoretical syllabus.  
Gymnosperms: Macroscopic - male and female strobilus of *Cycas*, and *Pinus*  
Anatomical slides (stelar types, transfusion tissue, sieve tube, sunken stomata, lenticel).  
Morphology: Inflorescence types.
4. **Spot identification (Scientific names and families) of the following Angiospermic plants:**  
*Sida rhombifolia* (Malvaceae), *Abutilon indicum* (Malvaceae), *Thespesia populnea* (Malvaceae), *Cassia sophera* (Fabaceae), *Tephrosia hamiltonii* (Fabaceae), *Crotalaria pallida* (Fabaceae), *Leucaena leucocephala* (Fabaceae), *Coccinia grandis* (Cucurbitaceae), *Solanum sisymbriifolium* (Solanaceae), *Nicotiana glauca* (Solanaceae), *Physalis minima* (Solanaceae), *Leucas aspera* (Lamiaceae), *Leonurus sibiricus* (Lamiaceae), *Anisomeles indica* (Lamiaceae), *Parthenium hysterophorus* (Asteraceae), *Tridax procumbens* (Asteraceae), *Mikania scandens* (Asteraceae), *Eclipta prostrata* (Asteraceae), *Eragrostis tenella* (Poaceae), *Chrysopogon aciculatus* (Poaceae), *Eleusine indica* (Poaceae), *Vanda tasellata* (Orchidaceae).
5. **Laboratory Records:** Laboratory note books (regularly signed) and slides (prepared in class) are to be submitted at the time of Practical Examination.
6. **Field Excursion:** Local Excursions (at least two including one to Acharya Jagadish Chandra Bose Indian Botanic Garden, Shibpur, Howrah).
7. **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.

## Module VI

50 Marks

1. **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.
2. **Anatomy:** Anatomical studies (following double-staining method) of:
  - i) Stem: *Cucurbita*, Maize.
  - ii) Root: Gram, Orchid.
  - iii) Leaf: *Nerium*, Tuberose.
3. **Cell Biology:**
  - i) Staining (Aceto-orcein) and squash preparation of onion root tip: study of mitotic stages.
  - ii) Determination of mitotic index (from onion root tip).
4. **Identification with reasons:**
  - i) Cytological slides of different mitotic and meiotic stages.
5. **Laboratory Records:** Laboratory note books (regularly signed) and slides (prepared in class) are to be submitted at the time of Practical Examination.

## DISTRIBUTION OF MARKS (PAPER-III)

Time : 6 Hours

Full Marks-100

### Module V

50 Marks

- |  |    |
|--|----|
| 6. Work out on Algae/Fungi (anyone)  | 9  |
| 7. Work out on Angiosperms   | 12 |
| 8. Identification: (2 x 7)<br>Algae/Fungi-1, Bryophyte-1, Pteridophyte-1, Gymnosperm-1,<br>Morphology-1, Angiosperms-2 (species and family). | 14 |
| 9. Submission: Laboratory records (laboratory note-book, slides) and Field records (field note book, herbarium sheets). (5+5) =              | 10 |
| 10. Viva-voce  | 5  |

### Module VI

50 Marks

- |  |    |
|--|----|
| 6. Plant Physiology Experiment                 | 12 |
| 7. Anatomy                                     | 12 |
| 8. Cell Biology                                | 10 |
| 9. Identification: (3x2) Anatomy-1, Cytology-1 | 6  |
| 10. Submission: Laboratory records             | 5  |
| 5. Viva-voce                                   | 5  |

## PART III Full Marks-100 (Theoretical-70 & Practical-30)

Paper-IVA (Theoretical)

Marks-70

### Module VII

- Biofertilizer:**  
1.1 Sources 1.2 Production, 1.3 Application.
- Mushroom:**  
2.1 Food value, 2.2 Cultivation technique of *Pleurotus*.
- Plant disease control:**  
3.1 Quarantine, 3.2 Biological control, 3.3 Chemical Control.
- Plant Breeding:**  
4.1 Mass and Pure line selection, 4.2 Heterosis and hybrid seed production.



5. **Biometry:**  
5.1 Measures of Central Tendency (Mean, Mode and Median), 5.2 Goodness of fit (Chi-square test).
6. **Plant tissue culture:**  
6.1 Callus culture and plant regeneration, 6.2 Micropropagation, 6.3 Somatic embryogenesis and Artificial seed, 6.4 Protoplast culture and applications.
7. **Recombinant DNA Technology:**  
7.1 Recombinant DNA, restriction enzymes, plasmids as vector, 7.2 Gene cloning (basic steps), 7.3 Transgenic plants.
8. **Pharmacognosy:**  
8.1 Scope and importance, 8.2 Secondary metabolites- alkaloids, terpenoids, phenolics and their functions, 8.3 Organoleptic evaluation of crude drugs.

## Paper-IVB (Practical)

30 Marks

### Module VIII

1. Acquaintance with laboratory instruments - Autoclave, Incubator, Clinical centrifuge, Analytical balance, pH Meter, Colorimeter, Water bath, Distillation plant.
2. Sterilization technique by autoclaving.
3. Preparation of PDA medium (slants, pouring of plates).
4. Bacteria staining by simple staining method (methylene blue/crystal violet) from curd.
5. Acquaintance with common medicinal plants and their useful parts : *Terminalia arjuna*, *Centella asiatica*, *Saraca asoca*, *Adhatoda vasica*, *Andrographis paniculata*, *Asteracantha longifolia*, *Eclipta alba*, *Aloe barbadensis*, *Rauvolfia serpentina*, *Vitex negundo*, *Herpestis monieria*, *Holarrhena antidysenterica*, *Boerhaavia repens*.
6. Determination of Goodness of fit of normal monohybrid ratios (3: 1 and 1: 1) by Chi-square analysis.
7. Visit to a Medicinal Plant Garden.

## DISTRIBUTION OF MARKS (PAPER - IVB)

### Module VIII

Time : 3 Hours

Full Marks-30

7. Microbiology	5
8. Biometry	8
9. Demonstration of a laboratory instrument	4
10. Identification of medicinal plants (2 x 2)	4
11. Submission (Laboratory note book & Field report)	4
12. Viva-voce	5

# **QUESTION PATTERN OF BOTANY (GENERAL), C.U.**

Type ('A', 'B', 'C') of questions of 1, 5, 10 marks each, respectively.

## **Paper-I**

### **Module I (50)**

- Q.1.** 'A' Type Questions- 10 marks  
(10 to be answered out of 15)  $1 \times 10 = 10$   
(3 questions to be set from each group)
- Q.2.** 'B' Type Questions-10 marks  
(2 to be answered out of 5)  $5 \times 2 = 10$   
(1 question to be set from each group)
- Q.3.** 'C' Type Questions-30 marks  
(3 to be answered out of 5)  $10 \times 3 = 30$   
(1 question to be set from each group)

### **Module II (50)**

- Q.1.** 'A' Type Questions- 10 marks  
(10 to be answered out of 15)  $1 \times 10 = 10$   
(3 questions to be set from each group)
- Q.2.** 'B' Type Questions-10 marks  
(2 to be answered out of 5)  $5 \times 2 = 10$   
(1 question to be set from each group)
- Q.3.** 'C' Type Questions-30 marks  
(3 to be answered out of 5)  $10 \times 3 = 30$   
(1 question to be set from each group)

## **Paper-II**

### **Module III (50)**

- Q.1.** 'A' Type Questions- 10 marks  
(10 to be answered out of 15)  $1 \times 10 = 10$   
(5 questions to be set from Anatomy &

10 questions to be set from Cell Biology & Genetics)

**Q.2.** 'B' Type Questions-10 marks

(2 to be answered out of 5)  $5 \times 2 = 10$

(1 question to be set from Anatomy &

4 questions to be set from Cell Biology & Genetics).

**Q.3.** 'C' Type Questions-30 marks.

a. Anatomy-1 question to be answered out of two.....  $10 \times 1 = 10$

b. Cell Biology & Genetics -2 question to be answered out of three..  $10 \times 2 = 20$

### **Module IV (50)**

**Q.1.** 'A' Type Questions- 10 marks.

(10 to be answered out of 15.  $1 \times 10 = 10$ ,

(10 questions to be set from Plant Physiology & Biochemistry and

5 questions to be set from Ecology+ Economic Botany)

**Q.2.** 'B' Type Questions-10 marks.

(2 to be answered out of 5)  $5 \times 2 = 10$ ,

(1 question to be set from Ecology,

1 question to be set from Economic Botany and

3 questions to be set from Plant Physiology & Biochemistry)

**Q.3.** 'C' Type Questions-30 marks.

a. Ecology + Economic Botany-1 question to be answered out of two.....  $10 \times 1 = 10$

b. Plant Physiology & Biochemistry -2 questions to be answered out of three..  $10 \times 2 = 20$

### **Paper-III (Practical)**

#### **Module V & VI**

#### **Paper-IVA**

#### **Module VII (70 Marks)**

**Q.1.** 'A' Type Questions-  $1 \times 15 = 15$  marks

(15 to be answered out of 20)

**Q.2.** 'B' Type Questions-  $5 \times 3 = 15$  marks

(3 to be answered out of 5)

**Q.3.** 'C' Type Questions-  $10 \times 4 = 40$  marks

(4 to be answered out of 6)

#### **Paper-IVB**

#### **Module VIII (30 Marks) - Practical**

#### **Suggested Readings**

Like 2007