

UNIVERSITY OF CALCUTTA
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)

CORE COURSES (4)

Each theoretical course of 4 credits and practical of 2 credits.

1. Plant diversity I (Phycology, Mycology, Phytopathology, Bryophytes and Anatomy) – a) Theoretical- BOT-G-CC-1-1-TH b) Practical- BOT-G-CC-1-1-P (... .. GE-1-1-TH & P)

2. Plant diversity II (Pteridophytes, Gymnosperms, Palaeobotany, Morphology and Taxonomy) – a) Theoretical- BOT-G-CC-2-2-TH b) Practical- BOT-G-CC-2-2-P (... .. GE-2-2-TH & P)

3. Cell biology, Genetics and Microbiology – a) Theoretical- BOT-G-CC-3-3-TH b) Practical- BOT-G-CC-3-3-P (... .. GE-3-3-TH & P)

4. Plant physiology and metabolism – a) Theoretical- BOT-G-CC-4-4-TH b) Practical- BOT-G-CC-4-4-P (... .. GE-4-4-TH & P)

N.B.: The above said four core courses (CC) may be considered as GE 1, 2, 3 & 4 respectively for the honours students of other allied disciplines opting Botany as one of the general courses.

Skill enhancement courses (SEC, four courses to be selected strictly on 2 subjects out of 3 subjects opted taking 2 courses from each subject. Each general subject shall have 2 groups (A & B) of SEC papers. One paper from Group A from each of the 2 subjects to be chosen in the 3rd and 5th Semester, one paper from Group B of each of the 2 subjects to be chosen in the 4th and 6th Semesters. Each paper of 2 credits and theoretical only)

SEC A

1. Plant breeding and biometry (BOT-G-SEC-A-3/5-1)
2. Biofertilizers (BOT-G-SEC-A-3/5-2)

SEC B

1. Plant biotechnology (BOT-G-SEC-B-4/6-3)
2. Mushroom culture technology (BOT-G-SEC-B-4/6-4)

Discipline specific elective courses (DSE, two courses to be selected from the list taking one each from Group A in 5th semester and one from Group B in 6th Semester. Each course comprises of theoretical component of 4 credits and practical ones of 2 credits)

DSE A

1. Phytochemistry and medicinal botany- a) Theoretical- BOT-G-DSE-A-5-1-TH, b) Practical- BOT-G-DSE-A-5-1-P
2. Natural resource management- a) Theoretical- BOT-G-DSE-A-5-2-TH, b) Practical- BOT-G-DSE-A-5-2-P

DSE B

3. Economic botany- a) Theoretical- BOT-G-DSE-B-6-3-TH, b) Practical- BOT-G-DSE-B-6-3-P
4. Horticultural practices and post harvest technology - a) Theoretical- BOT-G-DSE-B-6-4-TH, b) Practical- BOT-G-DSE-B-6-4-P

SEME STER	CORE COURSES (CC-1-4)	ABILITY ENHANCEMENT COMPULSORY COURSE (AEC-1&2)	SKILL ENHANCEMEN T COURSE (SEC-1-4)	DISCIPLINE SPECIFIC ELECTIVE COURSE (DSE-1&2)
I	PLANT DIVERSITY I (PHYCOLOGY, MYCOLOGY, PHYTOPATHOLOGY, BRYOPHYTES AND ANATOMY) BOT-G-CC-1-1-TH	AECC-1 ENGLISH COMUUNICATIO N		
	PRACTICALS BOT-G-CC-1-1-P			
	OTHER DESCIPLINES (2)			
II	PLANT DIVERSITY II (PTERIDOPHYTES, GYMNOSPERMS, PALAEOBOTANY, MORPHOLOGY AND TAXONOMY) BOT-G-CC-2-2-TH	AECC-2 ENVIRONMENTA L SCIENCE		
	PRACTICALS BOT-G-CC-2-2-P			
	OTHER DESCIPLINES (2)			
III	CELL BIOLOGY, GENETICS AND MICROBIOLOGY BOT-G-CC-3-3-TH		SEC-A	
	PRACTICALS BOT-G-CC-3-3-P			
	OTHER DESCIPLINES (2)			
IV	PLANT PHYSIOLOGY AND METABOLISM BOT-G-CC-4-4-TH		SEC-B	
	PRACTICALS BOT-G-CC-4-4-P			
	OTHER DESCIPLINES (2)			
V			SEC-A	DSE-A (any one from GROUP A) THEORY & PRACTICAL
				OTHER DESCIPLINES (2)
VI			SEC-B	DSE-B (any one from GROUP B) THEORY & PRACTICAL
				OTHER DESCIPLINES (2)

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 (Metcalfe & Chalk), 6.2 Anatomy of root, stem and leaf of monocots and dicots, 6.3 Stellar types and evolution, 6.4 Secondary growth – normal in dicot stem and anomaly in stem of *Tecoma* & *Dracaena*.

.....12 lectures

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,

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, Labiatae (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).

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

RACTICAL- 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

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 C₃ and C₄ 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 O₂ during photosynthesis (using graduated tube).

v) Evolution of CO₂ 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.

-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

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 brief idea about indigenous medicinal sciences- Ayurveda, Siddha and Unani. Polyherbal formulations.
.....14 lectures
2. **Pharmacognosy**- 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, Curcuminoids), 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.

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 non-biodegradable) 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 O₂ by azide modification of Winkler's method.
5. Determination of chemical properties of soil by rapid spot test (carbonate, iron, nitrate)

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, raddish, 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).

.....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.

REFERENCES

Suggested Readings

1. General studies

1. Ganguli, H.C., Das, K.S.K. & Dutta, C.T. College Botany, Vol. I, latest Ed., New Central Book Agency
2. Ganguli, H.C. and Kar, A.K. College Botany, Vol. II, latest Ed., New Central Book Agency
3. Mukherjee, S. College Botany, Vol. III, latest Ed., New Central Book Agency
4. Uno, Storey & Moore, Principles of Botany, 2001, McGraw Hill.
5. Kenrick, P. & Crane, P. The Origin & early diversification of land plants (1997), Smithsonian Institute Press.
6. Bell, P.R. & Hensley, A.R. Green plants; their Origin & Diversity (2nd ed.), 2000, Cambridge University Press
7. Frenkel, T. The origin & early Evolution of life, 2002, Oxford University Press.
8. Hait, G., Ghosh, A. and Bhattacharya, K. A Text Book of Botany (Vols. I, II & III), 2007, New Central Book Agency
9. Lock, A.J., & Evans, D.E., Plant Biology, 2001, Viva Books
10. Chatterjee, T., Santra, S.C. and Das, A. Practical College Botany, New Central Book Agency

2. Algae

1. Kumar, H.D. Introductory Phycology (2nd ed.), 1999, Affiliated East-West Press Pvt. Ltd.
2. Lee, R.E. Phycology (3rd ed.), 1999, Cambridge University Press
3. Vashishta, B.R., Sinha, A.K. & Singh, V.P. Algae (9th ed.), 2002, S. Chand & Company
4. Sambamurthy, A.S.S. A text book of Algae, 2005, I.K. International Pvt. Ltd. 22
5. Graham, L.E. & Wilcox, L.W. Algae, 2000, Prentice Hall
6. Smith, G.M. Cryptogamic Botany, Vol. 1 (2nd ed.), 1955. McGraw Hill
7. Prescott, G.W. Algae: A Review: 1969 Bishen Singh Mahendra Pal Singh
8. Fritsch, F.E. The Structure & Reproduction of Algae, 1936, Vols. I & II, Cambridge University Press

3. Microbiology

1. Stainer, T.Y., Ingrahm, J.L., Wheelis, M.L. & Painter, P.R. General Microbiology (5th ed.), 1986, Macmillan Education Ltd.
2. Dubey, R.C. & Maheswari, D.K. A Text Book of Microbiology, 2005, S.Chand & Company
3. Case. Funke & Tortora, G.J. Microbiology, an Introduction (Latest Ed.)
4. Jay, J.M. Modern Food Microbiology (5th ed.), 1996, Chapman & Hall
5. Madigan, M.T., Marinko, J.M. & Parker, J. Brock, Biology of Microorganisms (10th ed.), 2003, Prentice Hall
10. Hull, R. Matthew Plant Virology (4th ed.), 2002, Academic Press
6. Biswas, S.B. & Biswas, A. An Introduction to Viruses (4th ed.), 1996, Vikas Publishing House
7. Agarwal, A.K. & Parihar, P. Industrial Microbiology, 2005, Agrobios (India)

8. Power, C.B. & Dagimawata, H.F. General Microbiology, Vol. I&II, Himalaya Publishing House
9. Mitchel, R. Environmental Microbiology, Latest Ed. Wiley, N.Y.
10. Sale, A.J. Fundamental Principles of Microbiology, Latest Ed., Tata McGraw Hill
11. Banerjee, A.K. & Banerjee, N. Microbiology & Immunology, 2006, new Central Book Agency
12. Prescott & Dunn. Industrial Microbiology 18. Verma, H.N. Basics of Plant Virology (2003), Oxford and IBH

4. Fungi, Lichen & Plant Pathology

1. Dubey, H.C. An Introduction to Fungi (2nd ed.), 1990, Vikas Publishing House 23
2. Arora, D. (ed.). Hand book of Fungal Biotechnology (2nd ed.), 2003, Dekker, N.Y.
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