

UNIVERSITY OF CALCUTTA
Course Structure- 3 yr MDC (NEP 2020)
BOTANY

	CC1	CC2	Minor	IDC	AEC	SEC	CVAC	Summer Internship	Credit
Semester									
Level 100									
1	BOT-MD-CC1-1-Th BOT-MD-CC1-1-P Plant Diversity			Plants Around Us* (Th+Pr)		BOT-MD-SEC-1-Th BOT-MD-SEC-1-P Mushroom Cultivation Technology*** (Th+Pr)	1.ENVS 2.CV		21
2	BOT-MD-CC2-2-Th BOT-MD-CC2-2-P Plant Systematics						1.ENVS 2.Central Pool	Summer Internship **	21
<i>Exit option</i>									
Level 200									
3	BOT-MD-CC3-3-Th BOT-MD-CC3-3-P Economic Botany		Plant Diversity (Th+Pr)						21
4	BOT-MD-CC4-4-Th BOT-MD-CC4-4-P Pharmacognosy & Ethnobotany		Plant Systematics (Th+Pr)					Summer Internship**	22

	BOT-MD-CC5-4-Th BOT-MD-CC5-4-P Plant Geography, Ecology & Evolution								
Exit option									
Level 300									
5	BOT-MD-CC6-5-Th BOT-MD-CC6-5-P Plant anatomy & Embryology BOT-MD-CC7-5-Th BOT-MD-CC7-5-P Cell Biology & Genetics		Economic Botany (Th+Pr) Pharmacognosy & Ethnobotany (Th+Pr)						20
6	BOT-MD-CC8-6-Th BOT-MD-CC8-6-P Plant Physiology & Biochemistry		Cell Biology & Genetics (Th+Pr) Plant Physiology & Biochemistry (Th+Pr)					Summer Internship**	20
Credits	8×4=32	8×4=32	6×4=24	3×3=9	4×2=8	3×4=12	4×2=8	1×3=3	128

Marks	8×100=800	8×100=800	6×100=600	3×75=225	4×50 =200	3×100=300	4×50=20 0		Total Marks = 3200
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Marks = 25 marks per credit.

Total credit = 125 + 3 (for summer internship) = 128

*** IDC offered from Botany to be opted in 1st or 2nd or 3rd Semester**

****Summer Internship once after 2nd or 4th or 6th Semester.**

*****SEC to be opted in 1st or 2nd or 3rd Semester.**

UNIVERSITY OF CALCUTTA
Course Structure- 3yr MDC (NEP 2020)

BOTANY SYLLABUS

Semester 1

Core

PLANT DIVERSITY (THEORY)

BOT-MD-CC1-1-Th

Total marks 75; Credits 3, Class 45 hours

1. Introduction to plant kingdom.

1.1 Origin of life and evolution of plant cells, 1.2 Importance of plants as source of food, fuel and their role in ecosystem services (as carbon sink, sequestering etc.)

(3 lectures)

2. Algae

2.1. Salient features of Cyanophyceae, Chlorophyceae, Charophyceae, Phaeophyceae, Rhodophyceae and Bacillariophyceae 2.2 Criteria and system of classification (Fritsch, 1935) 2.3. Economic importance of algae in environment, agriculture, biotechnology and industry.

(6 lectures)

3. Fungi

3.1 Salient features of Myxomycota, Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina. 3.2 System of classification up to Sub-division (Ainsworth, 1973), 3.3 Economic importance of fungi (food, medicine and agriculture), 3.4 Fungal symbioses: Mycorrhiza, Lichen and their importance.

(6 lectures)

4. Bryophytes

4.1 Salient features of Hepaticopsida, Anthocerotopsida and Bryopsida, 4.2. System of classification up to Class (Proskauer 1957), 4.3 Amphibian nature of bryophytes, 4.4 Economic and ecological importance.

(6 lectures)

5. Pteridophytes

5.1 Salient features of Psilophyta, Lycophyta, Sphenophyta and Filicophyta, 5.2 System of classification up to Division (Gifford & Foster 1989), 5.3 Economic importance (food, medicine & agriculture).

(6 lectures)

6. Gymnosperms

6.1 Salient features of Cycadophyta, Coniferophyta and Gnetophyta, 6.2 Outline classification up to Division: Progymnospermophyta to Gnetophyta (Gifford & Foster 1989), 6.3 Economic importance (wood, resin, essential oil & drugs).

(6 lectures)

7. Angiosperms

7.1 Types and morphology of leaf, stem and root, 7.2 Inflorescence types with examples, 7.3 Flower: Different parts and forms of calyx, corolla, androecium and gynoecium; aestivation and placentation, 7.4 Types with examples-fruits and seeds.

(12 lectures)

PLANT DIVERSITY (PRACTICAL)
BOT-MD-CC1-1-P
Total marks 25; Credit 1, Class 30 hours

- | | |
|---|-----------------|
| 1. Work out: Morphology | 10 marks |
| 2. Identification with reasons (other groups except angiosperms) | 5 marks |
| 3. Class room performance (Practical notebook) | 3 marks |
| 4. Field notebook | 2 marks |
| 5. Viva-voce | 5 marks |

1. Flower- dissection, drawing and study
 - a) Different parts, b) Adhesion and cohesion, c) Placentation, d) Aestivation
2. Study of ovules: types (Fresh specimens/ permanent slides/ photographs)
3. Fruits:different types- study from fresh/ preserved specimens
4. Inflorescence types: study from fresh/ preserved specimens
5. Identification on the basis of reproductive and structural features from preserved specimens/ permanent slides: Algae (*Nostoc*, *Oedogonium* and *Ectocarpus*), Fungi (*Rhizopus*, *Ascobolus* and *Agaricus*), Bryophytes (*Marchantia*, *Anthoceros* and *Funaria*), Pteridophytes (*Selaginella*, *Equisetum* and *Pteris*), Gymnosperms (male cone and female cone/ megasporophyll of *Cycas*, *Pinus* and *Gnetum*).
6. A field notebook supported with photographs taken during field study to be submitted giving comprehensive idea about different types of inflorescence, flowers and fruits.

Textbook Reference:

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. Frenchel, 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. Mitra, D., Guha, J. & Chowdhuri, S.K. Studies in Botany (Vols. I & II), Latest Ed., Das Printers
11. Chatterjee, T., Santra, S.C. and Das, A. Practical College Botany, New Central Book Agency

IDC in BOTANY (To be opted in 1st or 2nd or 3rd semester)

PLANTS AROUND US (THEORY)

Total marks 50; Credits 2, Class 30 hours

1. Introduction: 1.1 Introduction to plant groups: Algae, Bryophytes, Pteridophytes, Gymnosperms, Angiosperms (Monocot and Dicot); 1.2 Fungi -general characters; 1.3. Contributions of Theophrastus, Charak, Sushruta, Linnaeus, Mendel and J.C. Bose.
(5 lectures)
Plant body: 2.1 Plant cell and tissue; 2.2 Morphology of root, stem, leaf, flower, fruit and seed.
(5 lectures)
2. Plants and ecosystem: 3.1 Phytodiversity and conservation; 3.2 Biodiversity hotspots of India; 3.3 Forest types in India; 3.4 Plant-based adaptations to climate change; 3.5 Concept of 'Carbon footprint'- role of plants in reducing carbon footprint.
(5 lectures)
3. Plants and society: 4.1 Plants in day-to-day life (brief general information including uses)- major cereals (rice, wheat and maize); 4.2 pulses (mung and pea); 4.3 Oil (mustard and coconut); 4.4 Sugar (sugarcane and beet root); 4.5 Vegetables (potato, brinjal, ladies finger and spinach); 4.6 Fruits (apple, banana, guava, mango and jackfruit); 4.7 Beverages (tea, coffee, beer and wine); 4.8 Plants as timber (sal and teak); 4.9 Non-timber- energy (fossil and non-fossil), resin, honey and essential oil (lavender and citronella oil); 4.10 Fiber (jute and cotton); 4.11 Ornamental plants (rose, marigold, tuberose, gulmohar, jarul, kalanchoe); 4.12 Importance of bacteria (*Lactobacillus*, *E. coli* and *Rhizobium*) and Fungi (*Phytophthora*, *Agaricus* and *Penicillium*).
(10 lectures)
4. Plants and human health: 5.1 Important medicinal plants and their uses- basak (*Justicia adhatoda*), ghritakumari (*Aloe vera*), cinchona (*Cinchona officinalis*), neem (*Azadirachta indica*), kalmegh (*Andrographis paniculata*), pudina (*Mentha arvensis*), tulsi (*Ocimum sanctum*), sarpagandha (*Rauvolfia serpentina*); 5.2 Plant-derived medicinal compounds and uses (Quinine, Reserpine, Vincristine, Curcumin, Gingerol).
(5 lectures)

PLANTS AROUND US (PRACTICAL)

Total marks 25; Credit 1, Class 30 hours

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|----------------------------------|---------------|
| 1. Workout: Dissection of flower | 2+4 = 6 marks |
| 2. Identification | 3x3 = 9 marks |
| 3. Practical records/notebook | 5 marks |
| 4. Viva voce | 5 marks |

Identification: Morphological study plant specimens

Microscopic study – *Nostoc*, *Oedogonium* (with oogonium), *Rhizopus*, *Penicillium* (sporangiophore).

Macroscopic study – *Agaricus* (fruit body), *Marchantia* with gemma cup, antheridiophore/archaeogoniophore, Moss sporophyte, *Pteris* (fertile leaf/pinna), *Pinus* – male and female cone.

Fruits of tomato, peas, cucumber, citrus, apple & banana.

Work out of flower: Floral parts of *Hibiscus rosa-sinensis*, *Clitoria ternatea* & *Datura metel*.

Textbook references:

1. Studies in Botany (vol-I)- J.N.Mitra, Debabrata Mitra & Salil Chowdhury (Moulik Library)
2. A Textbook of Botany (Vol. I)- G. Hait, K. Bhattacharya & A. K. Ghosh (New Central Book Agency)
3. Udvigyan (Vol-I) (Bengali)- S. Chowdhury, N. Datta, D. Mitra & J. Guha (Moulik Library)
4. College Botany (vol II)-H.C. Gangulee, A.K. Kar, S.C. Santra (New Central Book Agency)
5. Snatak Udvigyan (Semester I)- Dr. Jayanta Kumar Sikdar, Dr. Kunal Sen, Dr. Pranab Giri (Santra Publication)

SEC (To be opted in 1st or 2nd or 3rd Semester)
MUSHROOM CULTIVATION TECHNOLOGY (THEORY)

BOT-MD-SEC-1-Th

Total marks 75; Credits 3, Class 45 hours

1. 1.1 Introduction, History of mushroom cultivation, 1.2 Current overview of mushroom production in the world, 1.3 Mushroom biology-classification of mushrooms, edible mushrooms in India, poisonous mushrooms, mushroom poisoning.

(6 lectures)

2. 2.1 Infrastructure-structural design and layout of mushroom farm, substrates (locally available), 2.2 Appliances- weighing balance, autoclave, laminar air flow, incubator, hot air oven, spirit lamp, Bunsen burner, pH meter, laboratory heater, low-cost stoves, water bath, humidifier, water sprayer, vessels, inoculation hook and inoculation loop, sieves, culture racks, tray, polythene bags, 2.3 Methods of sterilization.

(9 lectures)

3. 3.1 Cultivation technology-overview of cultivation strategies, composting technology in mushroom production, mushroom bed preparation, culture media, pure culture, maintenance and preservation of pure culture, 3.2 Production of spawn- cultivation of oyster mushroom, paddy-straw mushroom, milky mushroom and white button mushroom, 3.3 Cultivation of medicinal mushroom (Cordyceps and Ganoderma).

(12 lectures)

4. 4.1 Mushroom diseases and management strategies, 4.2 Post-harvest technology-short-term storage (Refrigeration- up to 24 hours), long-term storage (canning, pickles, papads etc.), drying, storage in salt solutions, 4.3 Food preparations from mushrooms.

(9 lectures)

5. 5.1 Uses of spent mushroom substrate, 5.2 Strain improvements in cultivated mushroom; Nutritional and medicinal value of edible mushrooms, 5.3 Research centres- National level and regional level, 5.4 Cost-benefit ratio, 5.5 Mushroom based Industry, 5.6 Mushroom market in India and abroad.

(9 lectures)

MUSHROOM CULTIVATION TECHNOLOGY (PRACTICAL)

BOT-MD-SEC-1-P

Total marks 25; Credits 1, Class 30 hours

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|----|---|----------|
| 1. | Work out: | 15 marks |
| 2. | Class room performance (Practical notebook) | 5 marks |
| 3. | Viva-voce | 5 marks |

1. Macro and microscopic identification of some common edible mushrooms (*Agaricus*, *Pleurotus*)
2. Media preparation
3. Fungal tissue culture
4. Sub-culturing for maintenance of culture
5. Spawn production
6. Cultivation of *Pleurotus/Calocybe*

Textbook Reference:

1. Acharya, K., Roy, A. & Sarkar, J. Mushroom Cultivation Technology, 2020, Techno World, Kolkata.
2. Marimuthu, T., Krishnamoorthy, A. S., Sivaprakasam, K. & Jayarajan, R. Oyster Mushrooms, 1991, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
3. Swaminathan, M. Food and Nutrition, 1990, Bappco, The Bangalore Printing & Publishing Co. Ltd.
4. Tewari, P. & Kapoor, S.C. Mushroom Cultivation, 1988, Mittal Publications, Delhi
5. Bahl, N. Handbook of Mushrooms, Ed. II, Vol I & Vol II

Semester 2
Core
PLANT SYSTEMATICS (THEORY)
BOT-MD-CC2-2-Th
Total marks 75; Credits 3, Class 45 hours

1. Introduction:

Components of Systematics: Nomenclature, Identification, Classification; 1.2. Taxonomy and its phases - Pioneer, Consolidation, Biosystematic and Encyclopaedic; alpha- and omega- taxonomy, 1.3 Nomenclature: Type method, Publication, Rank of taxa, Rules of priority, Retention and rejection of names, Author Citation, Effective and valid publication, Elementary knowledge of ICN- Principles.

(10 lectures)

2. Systems of classification:

2.1 Broad outline of Bentham & Hooker (1862-1883) and Takhtajan (1997)- systems of classification with merits and demerits. Brief idea of angiosperm phylogeny group (APG IV classification), 2.2 Systematics in Practice: Herbaria and Botanic Gardens – their role in teaching and research; 2.3. Dichotomous keys – indented and bracketed. 2.4 Brief idea on Phenetics and cladistics: Monophyletic, polyphyletic and paraphyletic groups; Plesiomorphy and apomorphy; 2.5 Numerical taxonomy- methods and significance;

2.6 Data sources in Taxonomy: Supportive evidences from Phytochemistry, Cytology, Palynology and Molecular biology data (Protein and Nucleic acid homology).

(20 lectures)

3. Systematic study of angiosperm taxa: Diagnostic features, systematic position (Bentham & Hooker) and economically important plants (parts used and uses) of the following families:

3.1. Monocotyledons: Alismataceae, Gramineae (Poaceae), Cyperaceae, Palmae (Arecaceae), Liliaceae, Musaceae, Zingiberaceae, Cannaceae, Orchidaceae.

3.2. Dicotyledons: Nymphaeaceae, Magnoliaceae, Ranunculaceae, Leguminosae (subfamilies), Euphorbiaceae, Malvaceae, Umbelliferae (Apiaceae), Labiatae (Lamiaceae), Cruciferae (Brassicaceae), Solanaceae, Scrophulariaceae, Acanthaceae, Rubiaceae, Cucurbitaceae, Compositae (Asteraceae).

(15 lectures)

PLANT SYSTEMATICS (PRACTICAL)

BOT-MD-CC2-2-P

Total marks 25; Credit 1, Class 30 hours

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|----|---|----------|
| 1. | Work out on angiosperms | 10 marks |
| 2. | Spot Identification | 3 marks |
| 3. | Class room performance (Practical notebook) | 2 marks |
| 4. | Field records (field notebook, herbarium specimens) | 5 marks |
| 5. | Viva-voce | 5 marks |

ANGIOSPERMS

1. Work out, description, preparation of floral formula and floral diagram, identification up to genus with the help of suitable literature of wild plants and systematic position according to Bentham and Hooker system of classification from the following families: Malvaceae, Leguminosae (Papilionaceae), Solanaceae, Scrophulariaceae, Acanthaceae, Labiatae (Lamiaceae), Rubiaceae.
2. Spot identification (Binomial, Family) of common wild plants from families included in the theoretical syllabus .

FIELD WORK

At least three excursions including one excursion to Acharya Jagadish Chandra Bose Indian Botanic Garden (Shibpur, Howrah) and one to Central National Herbarium (CNH).

FIELD RECORDS

1. Field Note Book (authenticated) with field notes on the plants of the area of excursion and voucher specimen book.
2. Herbarium specimens: Preparation of 20 angiospermic specimens (identified with author citation, voucher number and arranged following Bentham and Hooker system of classification) to be submitted during examination.

Textbook References:

1. Paria, N.D., Plant Taxonomy & Biodiversity, 2022, Santra Publication Pvt. Ltd.
2. Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. and Donoghue, M.J. Plant Systematics, A Phylogenetic Approach (4th ed.), 2016, Sinauer Associates, Inc.
3. Jones, S.B. and Luchsinger, A.E. Plant Systematics (2nd ed.), 1987, McGraw Hill Book Company
4. Singh, G. Plant Systematics: An Integrated Approach (3rd ed.), 2016, CRC Press
5. Sambamurthy, A.V.S.S. Taxonomy of Angiosperms, 2005, I.K. International Pvt. Ltd.
6. Sivaranjan, V.V. Principles of Plant Taxonomy (2nd ed.), 1991, Oxford & IBH
7. Subrahmanyam, N.S. Modern Plant Taxonomy, Latest Ed., Vikas Publishing House
8. Naik, V.N. Taxonomy of Angiosperms, Latest Ed., Tata McGraw Hill
9. Stace, C. A Plant Taxonomy & Biosystematics, Latest Ed., Arnold Publishers
10. Mitra, J.N. An Introduction to Systematic Botany & Ecology, Latest Ed., World Press
11. Dutta, S.C. Systematic Botany, Latest Ed., Wiley Eastern.
12. Lawrence, G.H.M. Taxonomy of Vascular Plants Ed., Oxford & IBH.
13. Prain, D. Bengal Plants (Vol I & II), Bishen Singh Mahendra Pal Singh.
14. Jeffrey, C. An Introduction to Plant Systematics, Latest Ed., Allied Publishers Pvt. Ltd.
15. Radford, A.B. Fundamentals of Plant Systematics, Latest Ed., Harper & Row.
16. Simpson, G. Plant Systematics, 2006, 2010, 2019, Springer.
17. Bhattacharya, B. Systematic Botany, 2006, Narosa Publishing House.
18. Heywood, V.H. Plant Taxonomy 1967, Edward Arnold, London.
19. Cronquist, A. The Evolution & Classification of Flowering Plant, 1988 (2nd ed.), New York Bot. Garden Bronx. New York.
20. Cronquist, A. An Integrated System of Classification of Flowering Plants. 1981. Bishen Singh Mahendra Pal Singh.
21. Subramanyam, N.S. Laboratory Manual of Plant Taxonomy (2nd ed.) 1999, Vikas Publishing House.
22. Heywood, V.H. Flowering Plants of the World 1978, Oxford University Press.