



ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

Guwahati

Course Structure and Syllabus

(From Academic Session 2020-21 onwards)

M.Sc. Botany (CBCS)

2nd Semester



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Course Structure

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M.Sc. Botany (CBCS)

2ND SEMESTER

Sl. No.	Sub-Code	Subject	Hours per Week			Credit	Marks	
			L	T	P		C	CE
Theory								
Core								
1	MBY202C201	Gymnosperms & Systematic Botany	4	0	0	4	30	70
2	MBY202C202	Anatomy & Embryology of Angiosperms	4	0	0	4	30	70
3	MBY202C203	Plant Physiology	4	0	0	4	30	70
Practical								
1	MBY202C214	Lab-III	0	0	8	4	30	70
2	MBY202C215	Lab-IV	0	0	8	4	30	70
Optional (Any One Paper)								
1	MBY2022E21	Plant Breeding & Horticulture	3	0	0	3	30	70
2	MBY2022E22	Orchidology	3	0	0	3	30	70
Total			15	0	16	23	180	420
Total Contact Hours per week: 31								
Total Credits: 23								

Detailed Syllabus

Course Code	Course Title	Hours per week L-T-P	Credit C
MBY202C201	Gymnosperms & Systematic Botany	4-0-0	4

Objectives:

- To acquire knowledge on the structure, reproduction and life cycle of different types of gymnosperms from lower form to advance groups.
- To study the basics of plant taxonomy such as description, identification, nomenclature and important classification.

Gymnosperms

14 lectures

Unit 1: General characteristics, Classification of gymnosperms, morphology, anatomy and reproduction of Cycadales (Cycas) and Coniferales (Pinus).

14 lectures

Unit 2: Morphology, anatomy and reproduction of Ephedrales (Ephedra) and Gnetales (Gnetum). Ecological and economic importance of gymnosperms.

Systematic Botany

14 lectures

Unit 3: Definition, basic concept and importance of systematics and taxonomy, plant identification, classification, botanical nomenclature, categories of taxonomic hierarchy, Keys – single and multi-access. Binomial system, typification, author citation, valid publication and rejection of names.

10 lectures

Unit 4: Methods of collecting plants, functions of herbarium, important herbaria and botanical gardens in India and Abroad, Taxonomic evidences from palynology, cytology, phytochemistry and molecular data.

8 lectures

Unit 5: History of angiospermic classification, types of classification - Linnaeus, Bentham and Hooker (upto series), Engler and Prantl (upto series) and outline of Taktajan classification.

Textbooks/Reference books:

1. Sporne, K. R. (1974). The Morphology of Gymnosperm. B.I. Publications, New Delhi.
2. Vasishta, P. C. et al. (2006). Botany for Degree Students: Gymnosperms. S. Chand and Co. Ltd., New Delhi.
3. Bhatnagar, S.P. and Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
4. Simpson, M.G. (2006). Plant Systematics. Elsevier Academic Press, San Diego, CA, U.S.A.
5. Singh, G. (2012). Plant Systematics: Theory and Practice. Oxford & IBH Pvt. Ltd., New Delhi. 3rd edition.
6. Angiosperm Phylogeny Group (2016). An update of the Angiosperm Phylogeny Group Classification for the orders and families of flowering plants: APG IV. Botanical Journal of the Linnaean Society 181: 1-20.
7. Crawford, D.J. (2003). Plant Molecular Systematics. Cambridge University Press, Cambridge, UK.

8. Judd, W.S., Campbell, C.S, Kellogg, E.A., Stevens, P.A. and Donoghue, M.J. (2016). Plant Systematics: A Phylogenetic Approach. Sinauer Associates, Inc., Massachusetts.
9. Simpson, M.G. (2010). Plant Systematics. Elsevier, Amsterdam.
10. Stuessy, T.F. (2009). Plant Taxonomy: The systematic Evaluation of Comparative Data. Columbia University Press, New York.
11. Stuessy, T.F., Crawford, D.J., Soltis, D.E. and Soltis, P.S. (2014). Plant Systematics: The origin, interpretation, and ordering, of plant biodiversity. Koeltz Scientific Books, Konigstein, Germany.

Course Code	Course Title	Hours per week L-T-P	Credit C
MBY202C202	Anatomy & Embryology of Angiosperms	4-0-0	4

Objectives:

- To acquire knowledge about the tissue structure, functions and various anatomical features of plants.
- To understand the growth and development of embryo.

Anatomy

8 lectures

Unit 1: Structure of dicot and monocot root, stem and leaf, Adaptive and protective system-epidermis, cuticle, stomata- structure, types & function, General account of adaptations in xerophytes and hydrophytes.

12 lectures

Unit 2: Root and shoot apical meristems; Theories and Classification of meristems, Simple (Parenchyma, Collenchyma & Sclerenchyma) and complex tissues (Xylem and Phloem). Cambium - types, origin and function – wound healing.

14 lectures

Unit 3: Nodal anatomy-unilacunar, trilacunar and multilacunar, Normal and Anomalous Secondary Growth - Achyranthes, Bignonia, Bougainvillea & Dracaena. Vascular cambium – structure and function, seasonal activity.

Embryology of Angiosperms

12 lectures

Unit 4: Structure of anther and pollen, Development of male gametophyte, Pollination, Structure and types of ovules, –Development of female gametophyte, Embryo sacs - monosporic (Polygonum) bisporic (Allium) and tetrasporic (Peperomia).

14 lectures

Unit 5: Concept of fertilization and Sexual Incompatibility - Double fertilization and Triple fusion - Development of Monocot and Dicot embryo, Endosperm (types, structure and functions), nutrition of embryo. Polyembryony, Apomixis, Apospory, Parthenocarpy.

Textbooks/Reference books:

1. Pandey, B.P. 2007. Plant Anatomy, S. Chand & Co. De, New Delhi.
2. Tayal, M.S. 2004 . Plant Anatomy, Rastogi Publications, Meerut.
3. Mauseth, J.D. (1988). Plant Anatomy. The Benjamin/Cummings Publisher, USA.
4. Cuttler, E.G. 1969. Plant Anatomy - Part I Cells & Tissue. Edward Arnold Ltd., London.
5. Esau K. 1985. Plant Anatomy (2nd ed.) Wiley Eastern Ltd. New Delhi
6. Maheswari, P. 1985. An Introduction to the Embryology of Angiosperms. Tata McGraw Hill Publishing Co.,Ltd., New Delhi.
7. Bhojwani, S.S. & Bhatnagar, S.P. (2011). Embryology of Angiosperms. Vikas Publication House Pvt. Ltd. New Delhi. 5th edition.
8. Singh, V., Pande, P.C. & Jain, D.K. 2005. Embryology of Angiosperms, Rastogi Publications, Meerut.

Course Code	Course Title	Hours per week L-T-P	Credit C
MBY202C203	Plant Physiology	4-0-0	4

Objectives:

- To understand the physico-chemical organization and functional aspects of plants.

12 lectures

Unit 1: Plant-water relations- Importance of water, diffusion, osmosis, water potential and its components; Movement of water from soil to plants (apoplast and symplast), Transpiration and its significance; Factors affecting transpiration; Root pressure and guttation, Translocation in phloem - Composition of phloem, girdling experiment, Pressure flow model, Phloem loading and unloading.

12 lectures

Unit 2: Mineral nutrition- Essential elements, macro and micronutrients, Criteria of essentiality of elements, Role of essential elements, mineral deficiency symptoms and disorders, Transport of ions across cell membrane, active and passive transport, carriers, channels and pumps.

12 lectures

Unit 3: Photosynthesis- absorption spectrum and action spectrum, photosynthetic pigments (Chl a, b, xanthophylls, carotene); structure of chloroplast, photosystem I and II, red drop and emerson enhancement effect, C3, C4 and CAM pathways of carbon fixation; photorespiration.

12 lectures

Unit 4: Respiration- glycolysis, anaerobic respiration, TCA cycle; oxidative phosphorylation, Glyoxylate, pentose phosphate pathway, gluconeogenesis, nitrogen metabolism- biological and non-biological nitrogen fixation, nitrate and ammonia assimilation.

12 lectures

Unit 5: Plant growth regulators- discovery and physiological roles of auxins, gibberellins, cytokinins, ABA, ethylene, plant response to light and temperature- photoperiodism- (SDP, LDP, Day neutral plants), phytochrome-discovery, structure and its action on flowering, vernalization- mechanism and their practical application, plant senescence and fruit ripening, plant movement and biological clock, .

Textbooks/Reference books:

1. Taiz, L., Zeiger, E., (2010). Plant Physiology. Sinauer Associates Inc., U.S.A. 5th Edition.
2. Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology. John Wiley & Sons, U.S.A. 4th Edition.
3. Bajracharya, D., (1999). Experiments in Plant Physiology- A Laboratory Manual. Narosa Publishing House, New Delhi.
4. V.K. Jain (2005). Text book of Plant Physiology. S. Chand and Company Ltd. New Delhi.
5. Devlin O.P. (1974). Plant Physiology, Affiliated East West Press Pvt. Ltd.
6. Noggle, G.R. and Fritz G. (1976) Introductory Plant Physiology, Prentice – Hall, India.
7. Salisbury, F.B. and Ross, S. (1974) Plant Physiology, Prentice – Hall, India.

Course Code	Course Title	Hours per week L-T-P	Credit C
MBY202C214	Lab-III	0-0-8	4

Gymnosperms

1. **Cycas**- morphology (coralloid roots, bulbil, leaf), t.s. coralloid root, t.s. rachis, v.s. Leaflet, v.s. microsporophyll, l.s. ovule.
2. **Pinus**- morphology (long and dwarf shoots, male and female), t.s. needle, t.s. stem, l.s./t.s. male cone, l.s. female cone.
3. **Ephedra** - study of morphology, anatomy and reproductive structures (permanent slide).
4. **Gnetum** – study of morphology, anatomy and reproductive structures (permanent slide).

Systematic Botany

1. Study of vegetative and floral characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification): Brassicaceae -Brassica, Asteraceae - Eclipta/Tridax; Solanaceae -Solanum nigrum, Withania; Lamiaceae - Salvia, Ocimum; Liliaceae - Asphodelus / Lilium / Allium.
2. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book).

Anatomy

1. Study of meristems through permanent slides and photographs.
2. Tissues (parenchyma, collenchyma and sclerenchyma); Macerated xylary elements, Phloem (Permanent slides, photographs)
3. Stem: Monocot: Zea mays; Dicot: Helianthus; Secondary: Helianthus
4. Root: Monocot: Zea mays; Dicot: Helianthus; Secondary: Helianthus
5. Leaf: Dicot and Monocot leaf.
6. Adaptive anatomy: Xerophyte (Nerium leaf); Hydrophyte (Hydrilla stem).

Embryology of Angiosperms

1. Structure of anther (young and mature)
2. Types of ovules: anatropous, orthotropous, circinotropous, amphitropous/campylotropous.
3. Female gametophyte: Polygonum (monosporic) type of Embryo sac Development (Permanent slides/photographs).
4. Ultrastructure of mature egg apparatus cells through electron micrographs.
5. Pollination types and seed dispersal mechanisms (including appendages, aril, caruncle) (Photographs and specimens).
6. Dissection of embryo/endosperm from developing seeds.

Course Code	Course Title	Hours per week L-T-P	Credit C
MBY202C215	Lab-IV	0-0-8	4

Plant Physiology

1. Determination of osmotic potential of plant cell sap by plasmolytic method.
2. To study the effect of two environmental factors (light and wind) on transpiration by excised twig.
3. Calculation of stomatal index and stomatal frequency of a mesophyte and a xerophyte.
4. Demonstration of Hill reaction.
5. Demonstrate the activity of catalase and study the effect of pH and enzyme concentration.
6. To study the effect of light intensity and bicarbonate concentration on O₂ evolution in photosynthesis.
7. Comparison of the rate of respiration in any two parts of a plant.
8. Separation of amino acids by paper chromatography.
9. Separation of Chloroplast by paper chromatography

Plant Breeding and Horticulture

Plant Breeding

1. Plant breeders kit
2. Self-incompatibility and Male sterility
3. Induction of polyploidy
4. Identification of plants of different ecological conditions
5. To study floral biology in wheat, gram, rapeseed and mustard.
6. To study about the type of ovules
7. To study Gametogenesis in Plants
8. Study the techniques of hybridization
9. To study hybridization techniques in groundnut
10. To study hybridization technique in wheat and gram
11. To study hybridization technique in rapeseed and – mustard
12. Study of male sterility in sorghum, bajra in field or lab by - staining the pollen grain.

Horticulture

1. Horticultural tools and implements used for various operations.
2. Preparation of nursery beds for raising root stock and seedlings.
3. Preparation of pot for planting, cleaning, media preparation, and filling.
4. Specialized plant parts used in propagation.
5. Propagation through layering.
6. Propagation by budding.
7. Propagation through grafting.
8. Preparation of growth regulators and method of application and propagation through cuttings.
9. Planning, layout and planting of horticultural crops.
10. Techniques of manuring and irrigation.
11. Bearing habits of horticultural crops, special training and pruning practices.
12. Identification of Ornamental Plants for avenues and lawn- grasses, hedges, edges plants of our country.

13. Identification of indoor and outdoor foliage ornamentals, cacti- succulents and bulbous plants
14. Study of varieties of chilli, citrus, banana, tomato and brinjal.

Orchidology

1. Tools and implements used for various operations.
2. Vegetative Morphology of a orchid plant.
3. Reproductive Morphology of orchids.
4. Preparation of pot for planting, cleaning, media preparation, and filling.
5. Orchid Pollination.
6. Reproductive Biology in Orchids.
7. Media and Growing Environment.
8. Techniques of manuring and irrigation.
9. Propagation of Orchids.
10. Ecology and Conservation (Orchid Cyropreservation)
11. Ethnobotany of Orchids.
12. Commercial Production of Orchids.
13. Different methods of Orchid Culture.
14. Orchid Pests and Diseases.

Orchid tissue Culture & Breeding

1. Identification of orchids.
2. Methods of orchid tissue culture and micropropagation.
3. Different media of tissue culture.
4. Culture of Dendrobium, Cymbidium hybrids.
5. Identification of plants of different ecological conditions
6. To study floral biology in Dendrobium in Cymbidium.
7. Study the techniques of hybridization.
8. To study hybridization techniques in Dendrobium.
9. To study hybridization technique in Cymbidium.
10. Study of varieties of commercially important Dendrobium, Cymbidium, Oncidium, Phalaenopsis, Cattleya and Vanda.

Course Code	Course Title	Hours per week L-T-P	Credit C
MBY2022E21	Plant Breeding & Horticulture	3-0-0	3

Objectives:

- To study the progress made in the field of Horticulture and Plant breeding.
- To understand the principle and to study the basic techniques in Horticulture and Plant breeding.

Plant Breeding

12 lectures

Unit 1: Introduction & scope, Selection – pure line, mass, and clonal. Hybridization – selfing and crossing techniques, Heterosis, Hybrid vigour – causes and achievements, Micropropagation, somatic embryogenesis, anther and embryo culture, green house, lathhouse, hotbeds and cold beds.

14 lectures

Unit 2: types of plant reproduction – vegetative, sexual and apomixis, Breeding for disease resistance – back cross method, polyploidy – types, role and achievements, Mutation breeding – physical and chemical mutagens - gamma garden, its application on plant breeding, role of mutation in plant breeding and achievements.

Horticulture

10 lectures

Unit 3: Introduction – Importance – Scope of horticulture – Divisions of horticulture – Pomology, Olericulture, Floriculture and Arboriculture, Classification of horticultural crops, Garden implements & tools. Types of garden – Formal, Informal and Kitchen garden, Establishment and maintenance of Lawn.

12 lectures

Unit 4: Methods of Plant Propagation – Cutting, Layering, Grafting and Budding. Stock – Scion relationship in grafting. Training & Pruning, Nursery preparation and maintenance, Role of growth hormones in horticulture – root induction, flowering, fruit setting, fruit development, seedless fruits and control of fruit drop.

12 lectures

Unit 5: Floriculture – commercial flowers - cultivation of Rose, Jasmine, Chrysanthemum and Crossandra, cut flowers – Indoor plants – Bonsai, cultivation of fruit trees – Mango, Banana and Sapota, Manures – organic manure and chemical fertilizers (N,P,K).

Textbooks/Reference books:

1. Kumar, N. (1987). Introduction to Horticulture, Rajalakshmi Publishers, Nagercoil.
2. Manibushan Rao, K. (1991). Textbook of Horticulture. Macmillan Publishing Co., NewYork.
3. Rao, K. M. (2000). Text Book of Horticulture. Macmillan India Ltd., New Delhi.
4. V.L. Sheela. (2011). Horticulture. MJP publishers, India.
5. Chopra, V. L. (1989). Plant Breeding. Oxford & IBH Publishing Co. Pvt. Ltd., NewDelhi.
6. Sundararaj, D. D. and Thulasidas, G. and Durairaj, M. S. (1997). Introduction to Cytogenetics and Plant Breeding. Popular Book Depot, Chennai.
7. Vijendra Das, L. D. (1998). Plant Breeding. New Age International Publishers, New Delhi.

8. Arora, J. S. (1992). Introductory Ornamental Horticulture. Kalyani Publishers, NewDelhi.
9. Edmond, J. B. et al. (1977). Fundamentals of Horticulture. Tata McGraw Hill Publishers Co. Ltd., New Delhi.
10. George Acquaah. (2002). Horticulture Principles and Practices. 2nd ed. PearsonEducation, Delhi.
11. Sundararajan J.S. et al. A guide to Horticulture. Thiruvankadam Printers, Coimbatore.

Course Code	Course Title	Hours per week L-T-P	Credit C
MBY2022E22	Orchidology	3-0-0	3

Objectives:

- To study on the principles and practices of orchid biology cultivation, conservation and culture.
- To provide students with broad perspective and greater appreciation for orchids, as well as to elucidate their potential and value as a commercial ornamental crop.
- To understand the principle and to study the basic techniques in orchid cultivation and commercialisation.

10 Lectures

Unit 1: Introduction, history of orchids and its cultivation, ecology and evolution of orchids – Importance – Classification & types of orchids, tools used for classifying orchids –orchid nomenclature and terminology used for species and hybrids, Scope of Orchidology.

12 Lectures

Unit 2: Reproductive morphology of orchids (i.e., pollinia, reproductive structures, etc.), Mechanisms that regulate flowering in orchids (i.e., photoperiodism, thermoperiodism, etc.)- Orchid culture, including different media and growing environments- Orchid nursery preparation and maintenance, Role of phytochemicals in orchid culture.

12 Lectures

Unit 3: Orchid genetics, as specifically related to flower colors- Floriculture – commercial orchid culture - cultivation of Dendrobium, Cymbidium, Oncidium, Phalaenopsis, Cattleya and Vanda, orchid cultivation for cut flowers – Types of plant nutrition and the role of hormones in orchids – use of biochemical in orchid cultivation, organic manure and chemical fertilizers (N,P,K).

12 Lectures

Unit 4: Methods of orchid Propagation – Seed germination, vegetative propagation including tissue culture– Pests and diseases of orchids – pollination mechanisms and the interaction flower-pollinator in orchids – ethnobotanical utilization of orchids- different systems for commercial production of orchids and respective markets.

14 Lectures

Unit 5: The world of orchids – Orchids in India and north- east, Orchids of Assam – Diversity of orchids according to forest type – Orchid conservation and its importance, Red data book and IUCN red list.

Textbooks/Reference books:

1. Berliocchi, L. (2004). *The Oorchid in Lore and Legend*, Timber Press, London.
2. Reinikka, M.A. (1972). *A History of the Orchids*. Timber Press, London.
3. Pritchard, H.W. (1989). *Modern Methods in Orchid Conservation*. Cambridge University Press, New York.
4. Reddy, J. (2008). *Biotechnology of Orchids*, I.K. International Publishing House Pvt. Ltd. New Delhi.

5. Misra, S., 2019. *Orchids of India- A hand book*. Bishen Singh Mahendra Pal Singh, Dehra Dun, India. 652 p.
6. Chowdhery, H. J. 1998. *Orchid Flora of Arunachal Pradesh*. Bishen Singh Mahendra Pal Singh, Dehra Dun, India.
7. Pradhan, U.C., 1979. *Indian Orchids Guide to Identification and Culture*. Vol- II. Thomson Prass, Faridabad, India. pp. 190–747.
8. Mukherjee, S (2019). *Orchids in Traditional Medicine*. Notion Press, Chennai.
9. Gogoi, K., 2019. *Orchids of Assam - A Pictorial Guide*. Dibrugarh University, Dibrugarh, Assam. 588 p.
10. Chowdhery, H. J. & D. K. Agrawala (2013). *A Century of West Himalayan Orchids*. Bishen Singh Mahendra Pal Singh, Dehra Dun, India.
11. Sundararajan J.S. et al. *A guide to Horticulture*. Thiruvankadam Printers, Coimbatore.
12. Chowdhery, S. 2005. *Assam's Flora*. Assam Science Technology and Environment Council, Guwahati, Assam, India.
13. Bhagabati, A.K., M. C. Kalita & S. Baruah, 2006. *Biodiversity of Assam*, Assam Science Society, Guwahati, Assam, India.
14. Dressler, R. 1993. *Phylogeny and Classification of Orchid Family*, Dioscorides press, Portland.
