



## **4 Year Under Graduate Degree (Honours) in Botany**

As per the guideline of the 4 year undergraduate degree (Hons) programme, a new curriculum has been formulated for 4 year under graduate course in botany for the affiliated colleges under the Cooch Behar Panchanan Barma University.

### **Programme Objective:**

According to this curriculum, the 1<sup>st</sup> year course containing two semesters have been proposed. The 1<sup>st</sup> SEM will have one Major and one Minor course with one MDC and SEC. A course AEC is a compulsory course for undergraduate students. The new curriculum offers essential knowledge and technical skills to the students to study the plants in a comprehensive way. Students will gain the knowledge in all spheres of plant science using core and advance components of the subject. Students will have the exposure to the upgraded new generation technologies that are currently used in the field of plant science. In that way, they will gain plethora of knowledge in the subject itself and its implication in environmental and social perspective.

This course covers both classroom and practical sessions. The students will be engaged in participatory and interactive activities. Candidates with curiosity in plants kingdom and environment and love in exploring exotic places as well as wish to work as researchers or professions like Botanist, Conservationist etc. can choose B.Sc. Botany course

### **Programme Outcome:**

#### **Major 1:**

After the completion of the course the students will be able to:

1. Understand on the origin of the cultivated plants across the globe.
2. Gather botanical knowledge of different types of fruits, i.e cereals, pulses, vegetables, fruits, spices etc.
3. Understand about some plants yielding drugs, timber, fibre, rubber, beverages etc.
4. A preliminary knowledge of economic plants.
5. Will also have the general idea about ethno medicine and familiarize with some of the important medicinal plants of the region that is North Bengal.
6. The students will also imbibe concept of ecological concept on the botanical aspect. They will also have knowledge on population study.
7. Phytogeography of Eastern Himalaya in Particular and general principle of phytogeographical study will be thoroughly conceptualized.

#### **Minor 1:**

Students will familiarize themselves with the knowledge on non flowering plants from algae to gymnosperms as well as fossils. In all the courses both theoretical and practical including field studies have been covered.

#### **Minor 2:**

In this course students will familiarize themselves with use of common plants as cereals, Legumes, vegetables, spices, timber etc. The students will also get general idea of plant ecology, plant taxonomy, plant morphology and plant anatomy.



### Syllabus Structure of Botany (Major):

Year	Semester	Major	Topics
1 <sup>st</sup>	I	Major 1	Economic Botany and Ethnomedicine
	II	Major 2	Ecology and Phytogeography
2 <sup>nd</sup>	III	Major 3	Phycology and Lichenology
		Major 4	Mycology and Phytopathology
	IV	Major 5	Bryology and Pteridology
		Major 6	Study of Gymnosperms and Paleobotany
3 <sup>rd</sup>	V	Major 7	Plant Morphology and anatomy
		Major 8	Systematics of Angiosperms
		Major 9	Plant Physiology
	VI	Major 10	Plant biochemistry
		Major 11	Cell Biology and Genetics
		Major 12	Microbiology
4 <sup>th</sup>	VII	Major 13	Molecular Biology
		Major 14	Plant biotechnology and Tissue culture
		Major 15	Plant Breeding, Biostatistics and Bioinformatics
		Major 16	Laboratory Techniques and Instrumentations
	VIII	Major 17	Microbial Biotechnology
		Major 18	Pharmacognosy
		Major 19	Bio-resource Management, Applied Botany and Evolution

### Syllabus Structure of Botany (Minor) based on 4YUGP 2023

Year	Semester	Minor	Topics
1 <sup>st</sup>	I		
	II		
2 <sup>nd</sup>	III	Minor 1	Phycology, Mycology and Plant Pathology, Bryology Pteridology, Study of Gymnosperms and Paleobotany
	IV	Minor 2	Taxonomy of Angiosperm, Ecology and Environment, Plant Morphology, Anatomy and Economic Botany.
4 <sup>th</sup>	VII	Minor 3	Plant Physiology and Plant Biochemistry, Cell Biology, Genetics. Plant biotechnology, Microbiology and Plant Breeding.
	VIII		

### Syllabus Structure of Botany (MDC) based on 4YUGP 2023

Year	Semester	MDC	Topics
1 <sup>st</sup>		MDC 1	Cultivation of Medicinal Plants



**Course:** Theory Syllabus of Major 1

**Paper Name:** Economic Botany and Ethnomedicine

**Paper Code:** BOT-MAJ1

**Origin of Cultivated Plants:** Vavilov's Concept of Centers of Origin of cultivated crop plants and its importance. Introduction, domestication, evolution of new crop varieties of rice, wheat and potato. Importance of germplasm and loss of genetic diversity.

**Cereals :** Wheat and Rice (morphology, processing & uses); Brief account of millets cultivated in India.

**Legumes:** Morphology and uses of Chick pea, Pigeon pea and fodder legumes. Importance to man and ecosystem.

**Sources of sugars and starches:** Morphology and processing of sugarcane, products and by-products of sugarcane industry. Potato – morphology, propagation & uses.

**Spices:** Listing of important spices, their family and part used. Economic importance with special reference to fennel, large cardamom, clove and black pepper.

**Beverages:** Tea (morphology, general processing of black tea and green tea & uses) Coffee (morphology, general processing and uses)

**Sources of oils and fats:** General description, classification, extraction, their uses and health implications of groundnut, coconut, soybean, mustard (Botanical name, family & uses).

**Citronella and Eucalyptus Oils:** General account, extraction methods, comparison with fatty oils & their uses.

**Natural Rubber:** Para-rubber (tapping, processing and uses).

**Drug and narcotics yielding plants:** Therapeutic and habit-forming drugs with special reference to *Cinchona*, *Digitalis*, *Papaver*, *Cannabis*; Tobacco (Morphology, processing, uses and health hazards).

**Timber plants:** General account with special reference to Teak and Sal.

**Fiber yielding plants:** Jute (Morphology, raturing of fiber and uses).

**Vegetables:** Okra, Cabbage. (Cultivation methods)

**Fruits:** Mango, Orange. (Varieties, fruit quality)

**Flowers:** Marigold and Tube rose. (Cultivation methods)

**Ethnomedicine:**

Definition; Importance of Ethnomedicine in India.

**Scientific name, family, parts used and uses of Plants used by ethnic people of North Bengal:** *Eclipta prostrata*; *Sesbania grandiflora*; *Glycosmis arborea*; *Vitex negundo*; *Coccinia grandis*(=*indica*); *Alstonia scholaris*, *Artemisia vulgaris*. *Andrographis paniculata*, *Centella asiatica*, *Rauvolfia serpentina*, *Oroxylum indicum*, *Terminalia spp*, *Ocimum sanctum*, *Justicia adhatoda*

**Course:** Practical Syllabus of Major 1

**Paper Name:** Economic Botany and Ethnomedicine

**Paper Code:** BOT-MAJ1

1. Habit sketch of plants included in theory syllabus.
2. Microscopic study of starch grains and fiber included in theory syllabus.
3. Excursion (Local and outstation, mandatory for each student) and Submission of dry specimen.



**Course:** Theory Syllabus of Major 2

**Paper Name:** Ecology and Phyto-geography

**Paper Code:** BOT-MAJ2

### **Theory Syllabus of Major 2**

#### **Ecology:**

**Introduction:** Basic concepts; Levels of organization. Inter-relationships between the living world and the environment, Biotic and abiotic components and their dynamism, homeostasis. BOD and COD.

**Biotic interactions:** Trophic organization, basic source of energy, autotrophy, heterotrophy; symbiosis, commensalism, parasitism; food chains and webs; ecological pyramids; biomass, standing crop.

**Habitat and niche:** Definition, Concept of habitat and niche; niche width and overlap, fundamental and realized niche; Characters displacement; analytical and synthetic; Ecotone and edge effect; ecological amplitude

**Ecosystems:** Structure; Processes (aquatic, grass land and forest).

**Adaptations:** Adaptations in hydrophytes, halophytes and xerophytes,

**Dynamics and Succession:** Processes, types; climax concepts.

**Functional aspects of ecosystem:** Principles and models of energy flow; Production and productivity; Ecological efficiencies; Biogeochemical cycles; Cycling of Carbon, Nitrogen and Phosphorus.

**Biogeochemical cycles:** Cycling of carbon, nitrogen and phosphorous.

**Population ecology:** Characteristics and Dynamics .Ecological Speciation.

#### **Phyto-geography:**

Principles; Continental drift; Theory of tolerance; Endemism; Brief description of major terrestrial biomes (one each from tropical, temperate & tundra); Phytogeographical division of India. Vegetation of Eastern Himalaya.

**Course:** Practical Syllabus of Major 2

**Paper Name:** Ecology and Phyto-geography

**Paper Code:** BOT-MAJ2

#### **Ecology and Phyto-geography:**

Determination of dissolved oxygen (O<sub>2</sub>) and carbon di oxide (CO<sub>2</sub>) of water samples from polluted and unpolluted sources.

Study of morphological adaptations of hydrophytes and xerophytes (four each).

Study of biotic interactions of the following: Stem parasite (*Cuscuta*), Root parasite (*Orobanche*) Epiphytes.

Excursion (Local and outstation, mandatory for each student) to familiarize students with ecology of different sites.

To prepare map showing vegetation of West Bengal and to comment on it.

To prepare map of India with respect to – Major Climatic Zones, Biogeographical regions of India and to comment on it.



**Suggested Reading (Botany Major):**

1. College Botany Vol. –I, II & III. - Gangulee and Kar, New Central Book Agency, Kolkata.
2. Studies in Botany, Vol. I. and II - Mitra, Mitra, Choudhury. Moulik Library, Kolkata.
3. Text Book of Botany, Vol.-1 and 2, By Hait, Ghosh and Bhattacharya, New Central Book Agency.
4. Botany – A. C. Datta, Oxford Univ. Press.
5. Ecology Environmental Science and Conservation J.S. Singh, S.R. Gupta & S.P. Singh S. Chand Publishing.
6. Economic Botany. B P Pandey. S. Chand Publishing.
7. Environmental Biology (Principles of Ecology). Dr. P S Verma & Dr. V K Agarwal. S. Chand Publishing.
8. Modern Practical Botany Vol-I, II. B P Pandey. S. Chand Publishing.
9. A Textbook of Plant Ecology (Including Ethnobotany & Soil Science). P S Chandel & R S Shukla. S. Chand Publishing.
10. Ecology and Utility of Plants. P S Chandel & R S Shukla. S. Chand Publishing.
11. College Botany Vol. I, II, III. B. P. Pandey. S. Chand Publishing.
12. College Botany Practical. Vol- I, II. S.C. Santra, A.P. Das auth.T.P. Chatterjee New Central Book Agency.



**Course:** Theory Syllabus of Minor 1

**Paper Name:** Phycology, Mycology and Plant Pathology, Bryology Pteridology, Study of Gymnosperms and Paleobotany.

**Paper Code:** BOT-MIN1

**Phycology:**

General account of major groups of Algae.

Range of thallus organization

Classification (Lee – 2008);

Life-cycles of the following algal genera: *Oedogonium*, *Chara* and *Vaucheria*,

Economic importance of algae.

**Mycology and Plant Pathology:**

General account of major groups of Fungi.

Economic importance and classification (Ainsworth and Bisby-1983)

Life cycle of *Mucor* (Zygomycota), *Penicillium* (Ascomycota), *Agaricus* (Basidiomycota). General account of Deuteromycetes.

Lichens: General account, reproduction and significance.

Mycorrhiza: ectomycorrhiza and endomycorrhiza and their significance.

Phytopathology: Koch's postulate. Structural and biochemical defense mechanism of plants. Control of Plant diseases: Physical, chemical and biological methods. Symptoms, disease cycles and control measures of Rust of wheat.

**Bryology:**

General characteristics of Hepaticopsida, Anthocerotopsida and Bryopsida.

Morphology, anatomy and reproduction of *Marchantia*, *Anthoceros* and *Funaria*. (Developmental details not to be included).

Ecological and Economic importance of bryophytes.

**Pteridology:**

General account of major groups of Pteridophyta (Both living and fossil).

Morphology, anatomy and reproduction of *Rhynia*, *Selaginella*, *Equisetum* and *Pteris*. (Developmental details not to be included).

Heterospory and seed habit, stelar evolution. Economic importance of Pteridophytes.

**Gymnology:**

General account of major groups of Gymnosperms (Both living and fossil)

Morphology, anatomy and reproduction of *Cycas* and *Gnetum*. (Developmental details not to be included).

Economical importance.

**Paleobotany:**

Terminologies and their definition (Paleobotany, Palynology, Palaeoforistics, Palaeoecology, fossils, subfossil).

Types of fossils on the basis of mode of preservation. Basic ideas of Geological time scale.



**Course:** Practical Syllabus of Minor 1

**Paper Name:** Phycology, Mycology and Plant Pathology, Bryology Pteridology, Study of Gymnosperms and Paleobotany.

**Paper Code:** BOT-MIN1

Study of following genera: *Nostoc*, *Oedogonium*, *Chara*, *Mucor*, *Marchantia*, *Funaria* (Vegetative and reproductive structure) and *Pteris* (Only reproductive structure), Fruit body of *Agaricus*.

Identification: Morphoanatomical studies of *Cycas* (leaflet, rachis, microsporophyll), Study (including mode of preservation) of the following: *Lepidodendron* (stem in T. S.), *Calamites* (stem in T. S.), *Lepidocarpon*, *Glossopteris*.

Wet specimen collection and preservation.

Excursion (Local and outstation, mandatory for each student).

**Course:** Theory Syllabus of Minor 2

**Paper Name:** Taxonomy of Angiosperm, Ecology and Environment, Plant Morphology, Anatomy and Economic Botany.

**Paper Code:** BOT-MIN2

**Taxonomy of Angiosperm:**

Introduction to plant taxonomy, Identification, Functions of Herbarium, important herbaria and botanical gardens of the world and India, Documentation, Concept of Flora, Keys.

Taxonomic hierarchy Ranks, categories and taxonomic groups

Botanical nomenclature: Principles and rules of ICN, binominal system, typification, author citation, valid and effective publication, rejection of names, principle of priority.

Types of classification- artificial, natural and phylogenetic. Bentham and Hooker's Classification system (upto series).

Study of Plant families: Ranunculaceae, Fabaceae, Solanaceae, Cucurbitaceae, Asteraceae, Poaceae and Orchidaceae

**Ecology and Environment:**

Introduction: Basic concepts; Levels of organization. Inter-relationships between the living world and the environment, the components and dynamism.

Biotic interactions: Trophic organization, basic source of energy, autotrophy, heterotrophy; symbiosis, commensalism, parasitism.

Plant communities: Habitat and niche; succession – processes, types; climax concepts.

Ecosystems: Structure; Processes; Food chains and Food webs; Ecological pyramids, Energy flow in ecosystem; Biogeochemical cycles; Cycling of Carbon and Nitrogen.

**Plant morphology and Anatomy**

**Leaves:** Types, phyllotaxy, stipules.

**Inflorescence:** Types with examples.

**Flower:** General characteristics, aestivation; placentation, floral formulae, floral diagram; adhesion and cohesion of floral parts.

**Fruits:** Definition and types.

**Ovule:** Organization only.

**Pollination:** Types and contrivances.



**Fertilization:** Process only.

**Endosperm:** Types only

**Cell wall:** Structure only.

**Tissue:** Definition, mechanical tissue and their distribution in plant bodies.

**Tissue system:** Epidermal (multiple epidermis, bulliform cells, stomatal types, trichoblasts, glandular hairs), vascular (leaf gap, branch gap, types of vascular bundles) and ground tissue system (General features of cortex, pith and medullary rays); Stele types.

**Secondary growth:** normal secondary growth in dicot shoot and root, concept of growth ring, ring and diffused porous wood, heart wood and sap wood, Periderm, Lenticel, commercial cork, bark.

**Anomalous secondary growth:** Definition and significance.

### **Economic Botany**

**Scientific name, family, Morphology, Parts used uses of the following:**

**Cereals:** Rice

**Legumes:** Black gram and soybean

**Vegetables:** Cabbage, Okra

**Spices:** Cardamom and black pepper

**Beverages:** Black Tea (including processing)

**Oils and Fats:** Mustard

**Fiber Yielding Plants:** Jute

**Timber:** Saal

**Narcotics:** Tobacco

### **Course: Practical Syllabus of Minor 2**

**Paper Name:** Taxonomy of Angiosperm, Ecology and Environment, Plant Morphology, Anatomy and Economic Botany

**Paper Code:** BOT-MIN2

Taxonomy Study of vegetative and floral characters of the common plants belonging to the families included in theory syllabus.

Morphological identification of economically important plants included in theory syllabus.

Study of Placentation (transverse section) and special inflorescence.

Study of stem anatomy of *Amaranthus* and *Lucas*. Study of xerophytic adaptations of *Nerium* leaf.

Preparation of temporary slide for observation of stomata by leaf peel method.

Determination of dissolved CO<sub>2</sub> of water samples from polluted and unpolluted sources.

Field visit to familiarize the students with ecology of different sites (Excursion; Local and outstation, mandatory for each student)





### **Suggested Reading (Botany Minor):**

1. College Botany Vol. –I, II & III. - Gangulee and Kar, New Central Book Agency, Kolkata.
2. Studies in Botany, Vol. I. and II - Mitra, Mitra, Choudhury. Moulik Library, Kolkata.
3. A Textbook of Botany Kashinath Bhattacharya, Ashim Kumar Ghosh and Gopinath Hait New central Book Agency.
4. Botany – A. C. Datta, Oxford Univ. Press.
5. Modern Practical Botany Vol-I, II. B P Pandey. S. Chand Publishing.
6. College Botany Vol. I, II, III. B. P. Pandey. S. Chand Publishing.
7. Botany for Degree Students – ALGAE. B R Vashishta, V P Singh & A K Sinha. S. Chand Publishing.
8. Botany for Degree Students – FUNGI. B R Vashishta, V P Singh & A K Sinha. S. Chand Publishing.
9. Botany for Degree Students - BRYOPHYTA . B R Vashishta, A K Sinha & Anil Kumar. S. Chand Publishing.
10. Botany for Degree Students-PTERIDOPHYTA. A K Sinha, Anil Kumar & P C Vashishta. S. Chand Publishing.
11. Plant Anatomy. B P Pandey. S. Chand Publishing.
12. Fundamental Botany. Dr. Kunal Sen, Dr. Pranab Giri. Satra Publication.
13. স্নাতক উদ্ভিদবিদ্যা. জয়ন্ত কুমার শিকদার, কুণাল সেন, প্রণব গিরি; (সম্পাদনা দুলাল চন্দ্র সাঁতরা) সাঁতরা publication.
14. ত্রি-বার্ষিক স্নাতক ব্যবহারিক উদ্ভিদবিদ্যা. ভূপেন্দ্র নাথ সান্যাল. নির্মালা লাইব্রেরী, কলকাতা.
15. UDVID BIGYAN (Vol-I, II, III) (Bengali) Debabrata Mitra, Jibesh Ghua, Salil Chowdhury & Naren Datta, Mallik Library, Kolkata



**Course:** Theory Syllabus of MDC1

**Paper Name:** Cultivation of Medicinal Plants

**Paper Code:** BOT-MDC1

**Cultivation of Medicinal Plants**

Scope and Importance of Medicinal Plants.

Conservation of endangered and endemic medicinal plants.

Propagation of Medicinal Plants: Through seeds and vegetative methods.

Preparation and management of the nursery, transplantation, harvesting, post-harvest care.

Cultivation techniques, cultural practices of the following medicinal plants: Chatim, Kalomegh, Sarpagandha, Haritaki, Tulshi, Basak, Ginger, Turmeric.

**Suggested Reading (MDC in Botany):**

1. Medicinal Plants: Ethnobotanical Approach. Trivedi P C, Agrobios, India.
2. Medicinal Plant Cultivation: A Scientific Approach, 2nd edn. Purohit and Vyas. Agrobios, India

INTERNSHIP (INTRN): (To be carried out at 2<sup>nd</sup> semester)

In this course students are required to participate in a professional activity to gain work experience or cooperative education activity with an entity external to the education institution, normally under the supervision of an expert of the given external entity. A key aspect of internship is induction into actual work situations. All students will also undergo internships in a firm, industry, or organization or training in labs with faculty and researchers in their own or other HEIs/research institutions during the summer term. NSS/NCC activities (apart from Regular/ Special NSS activities) may also be considered in the Internship during summer term.

**Dated:** 12.07.2023

---

(Chairman)  
Under Graduate Board of Studies in Botany  
Cooch Behar Panchanan Barma University.  
Coochbehar