



COOCHBEHAR
PANCHANAN BARMA
UNIVERSITY

**Syllabus for 4 Year Under Graduate Degree in Botany
Minor and MDC Course for the affiliated colleges
under the
Cooch Behar Panchanan Barma University,
Cooch Behar
Based on the guideline of 4YUGP 2023**

4 Year Under Graduate Degree in Botany

As per the guideline of the 4-year undergraduate degree program, 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.

Program Objective:

According to this curriculum, students opting Major in the subject other than Botany will study three Minor course. 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.

Minor 3 for the students who have opted Zoology / Physiology as Major:

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.

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

Year	Semester	Minor	Topics
1 st	I		
	II		
2 nd	III	Minor 3	Phycology, Mycology and Plant Pathology, Bryology Pteridology, Study of Gymnosperms and Paleobotany
	IV	Minor 4	Taxonomy of Angiosperm, Ecology and Environment, Plant Morphology, Anatomy and Economic Botany.
4 th	VII		
	VIII	Minor 6	Plant Physiology and Plant Biochemistry, Cell Biology, Genetics. Plant biotechnology, Microbiology and Plant Breeding.

Minor 4 for the students who have opted Zoology / Physiology as Major:

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.

Minor 6 for the students who have opted Zoology / Physiology as Major:

In this course students will familiarize themselves with essential knowledge and technical skills to study the Plant Physiology and Plant Biochemistry, Cell Biology, Genetics. Plant biotechnology, Microbiology and Plant Breeding. In this paper, students will also gain the practical knowledge in this field used by plant biotechnologist working in recent era. The knowledge in this field paves the path of modern plant biology and biotechnology.

Course: Theory Syllabus of Minor 3

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

Paper Code: BOT-MIN 3

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: *Mucor* (Zygomycota), *Penicillium* (Ascomycota), *Agaricus* (Basidi mycota). 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). Economic importance.

Paleobotany:

Terminologies and their definition (Paleobotany, Palynology, Palaeo-foristics, Palaeoecology, Fossils and Sub-fossils; Types of fossils on the basis of mode of preservation. Basic ideas of Geological time scale

Course: Practical Syllabus of Minor 3.

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

Paper Code: BOT-MIN3

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

Identification: Morpho-anatomical 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 4

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

Paper Code: BOT-MIN4

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; Bio-geochemical 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 4

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

Paper Code: BOT-MIN4

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 *Leucas*. Study of xerophytic adaptations of *Nerium* leaf. Preparation of temporary slide for observation of stomata by leaf peel method.

Determination of dissolved CO₂ of water samples from polluted and unpolluted sources.

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

Course: Theory syllabus of Minor 06

Paper Name: Plant Physiology and Plant Biochemistry, Cell Biology, Genetics. Plant biotechnology, Microbiology and Plant Breeding.

Paper Code: BOT-MIN 6

Plant Physiology:

Sensory photobiology: Concept of Photomorphogenesis, Function of photo sensory pigments (phytochromes, cryptochromes and phototropins), Long Day, Short day, Day Neutral plants, Structure of Phytochrome, photoperiodism and biological clock.

Secondary metabolites: Definition and Significance: Primary vs secondary metabolites; Different classes of Secondary metabolites -Alkaloids, Phenolics, Terpenoids (Elementary idea), functions and their applications.

Stress physiology: Basic Concepts of stress; Strain; Resistance; Types of stress: Biotic and abiotic; general responses: avoidance, tolerance, acclimation, Elementary concept of Oxidative stress.

Physiology of flowering: Photoperiodism; Flowering stimulus, Florigen concept, Vernalization and seed dormancy.

Plant Biochemistry:

Proteins: Classification of amino acids based on charge and polarity, peptide bond: Levels of protein structure-primary, secondary, tertiary and quaternary; Biological role of proteins.

Enzymes: Basic concept and structure- Holoenzyme, Apoenzyme, Cofactors, Coenzymes, prosthetic group and isozymes; Enzyme classification, Nomenclature, features of active site, substrate specificity, Mechanism of enzyme action (activation energy, lock and key hypothesis, induced-fit theory), Enzyme kinetics (Michaelis-Menten theory), Inhibition, Regulation.

Cell Biology:

Extra chromosomal Inheritance: Characteristic, study of extra chromosomal Inheritance in Variegation in Four o'clock plant; Maternal effects: shell coiling in snail; Infective heredity- Kappa particles in *Paramecium*.

Linkage, crossing over and chromosome mapping: Linkage and crossing over-Cytological basis of crossing over; Recombination frequency, two factor and three factor crosses; Interference and coincidence; Numericals based on gene mapping; Sex Linkage.

Genetics:

Gene mutations: Types of mutations; Molecular basis of Mutations; Mutagens – physical and chemical (Base analogs, deaminating, alkylating and intercalating agents); Detection of mutations: ClB method. Role of transposons in mutation. DNA repair mechanisms.

Population and Evolutionary Genetics: Allele frequencies, Genotype frequencies, Hardy-Weinberg Law, role of natural selection, mutation, genetic drift. Genetic variation and Speciation.

Plant biotechnology:

Recombinant DNA technology: Restriction Endonucleases (History, Types, biological role and application); Restriction Mapping (Linear and Circular); Cloning Vectors: Prokaryotic (pUC 18 and pUC1t, pBR322, Ti plasmid, BAC); Lambda phage, M13 phagemid, Cosmid, Shuttle vector; Eukaryotic Vectors (YAC).

Methods of gene transfer: *Agrobacterium* –mediated gene transfer.

Applications of Biotechnology: Pest resistant (Bt-cotton); herbicide resistant plants (Roundup Ready soybean); Transgenic crops with improved quality traits (FlavrSavr tomato, Golden rice); Improved horticultural varieties (Moon dust carnations); Role of transgenic in bioremediation (Superbug); edible vaccines; Industrial enzymes (Aspergillase, Protease, Lipase); Biosafety: Definition, objectives and guidelines in India and abroad, risk assessment (during laboratory research, for planned introduction, biotechnology products), risk regulations, planned introduction of GM plants.

Microbiology:

Basic Concept of Microbial Biotechnology: General introduction to microbial biotechnology, diversity of biotechnologically important microorganisms and rationale of utilization, basic concept of primary and secondary metabolism of microbes, primary and secondary metabolites for commercial interest, scope and applications. Mechanism of antibiotic resistance.

Microbial Products of Industrial Importance and Food Microbiology: Antibiotics, amino acids, organic acids, vaccines, biofuels, fermented products (alcoholic beverages), probiotics. Food borne diseases, spoilage of food, methods of food preservation.

Plant Breeding:

Plant breeding: An overview, objectives, achievements, and prospects.

Breeding for self-pollinated crops: Breeding for self-pollinated crops: Principles: Selection in self-pollinated crops; Hybridization – techniques and Consequences; heterosis and hybrid vigour; inbreeding depression. Methods: Mass selection and Pureline selection.

Course: Practical syllabus of Minor 06

Paper Name: Plant Physiology and Plant Biochemistry, Cell Biology, Genetics.
Plant biotechnology, Microbiology and Plant Breeding.

Paper Code: BOT-MIN 6

Comparison between rate of transpiration, evaporation and guttation.

Scoring of DNA bands and determination of relatedness of the samples.

Determination of molecular weight and / or molecular size of protein and/or DNA bands with respect to 'marker profile' for supplied protein /DNA gel image.

Quantities estimation of (a) proteins by Folin Phenol reagent (colorimetric estimation);

Study different stages of mitosis, mitotic index and karyotype of *Allium cepa* by aceto-orcein squash technique.

Study of meiosis of *Allium cepa* and *Rhoeo* by aceto-carmin smear technique.

Staining of micro flora from curd and root nodules.

Suggested Reading:

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 & AK Singh, S. Chand Publishing
8. Botany for Degree Students – Fungi. B R Vashishta, V P Singh & AK Singh, S. Chand Publishing.
9. Botany for Degree Students - Bryophyta . B R Vashishta, A K Sinha. S. Chand Publishing.
10. Botany for Degree Students - Pteridophyte . P C Vashishta, A K Sinha. S. Chand Publishing.
11. Plant Anatomy. B P Pandey. S. Chand Publishing
12. Fundamental Botany. Dr. Kunal Sen, Dr. Pranab Giri. Satra Publication
13. UDVID BIGYAN (Vol-I, II, III) (Bengali) Debabrata Mitra, Jibesh Ghua, Salil Chowdhury & Naren Datta, Mallik Library, Kolkata.
14. স্নাতক উদ্ভিদবিদ্যা. জয়ন্ত কুমার শিকদার, কুণাল সেন, প্রণব গারি; (সম্পাদনা দুলাল চন্দ্র সাঁতরা) সাঁতরা publication.
15. ত্রি-বার্ষিক স্নাতক ব্যবহারিক উদ্ভিদবিদ্যা. ভূপেন্দ্র নাথ সান্যাল. নির্মলা লাইব্রেরী, কলকাতা.

Course: Theory Syllabus of MDC1

Paper Name: Cultivation of Medicinal Plants

Paper Code: BOT-MDC1

Program Objective:

The objective of the course is to introduce the subject to those students who have very little ideas about the subject. The course has a humble start from very basic knowledge of cultivation of medicinal plants and economic botany and ends its journey in bio-informatics. During this three year journey the students will be enlightening with blessing of elementary knowledge of plant taxonomy, microbiology, plant biotechnology and molecular biology. This is a modest approach to introduce the subject in easy way to the students in a nut shell.

Program Outcome: The student will have a working idea about the subject botany as well as its importance in modern days in the field of sustainable development of nation and human civilization.

Syllabus:

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.

INTERNSHIP (INTRN): (To be carried out at 2nd 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) during summer term may also be considered as Internship during summer term.

Course: Theory Syllabus of MDC 2

Paper Name: Economic Botany I

Paper Code BOT-MDC 2

Scientific name, family, Parts used and uses of the crops belonging to the following groups: Cereals : Wheat and Rice, Maize, Jowar, Bajra and Kodo millets.

Legumes: Chick pea, Pigeon pea, Lentil, Arhar dal.

Sugarcane and sugar beets.

Spices: Fennel, large cardamom, clove, Cumin, Coriander, Asafoetida and black pepper.

Beverages: Tea, Coffee

Oil yielding crops: Groundnut, coconut, soybean, mustard.

Natural Rubber

Drug and narcotics yielding plants: *Cinchona*, *Digitalis*, *Papaver*, Aswagandha, Bringaraj, *Cannabis sativa*; Tobacco.

Timber plants: Teak, Bamboo, Sisoo, Jarul, Mehgani, Simul, Akashmoni and Sal.

Fiber yielding plants: Jute, Cotton, Hemp.

Vegetables: Okra, Cabbage, Potato, Brinjal, Cauliflower, Squash, Pumpkin, Bottle gourd.

Fruits: Mango, Orange, Pineapple, Jackfruit, Guava, Watermelon

Flowers: Marigold, *Crysanthemum*, Rose and Tube rose.

Course: Theory Syllabus of MDC 3

Paper Name: Advance Botany

Paper Code BOT-MDC 3

Plant Taxonomy: Preliminary ideas and history of plant taxonomy and classification.

General Microbiology: Morphology of bacteria and virus, economic importance of bacteria. Organic farming and bio-fertilizer.

Mushroom Cultivation: Nutritional values of mushroom and cultivation of *Pleurotus* sp.

Plant Pathology: Important pathogens of tobacco, rice, wheat and tea.

Biochemistry: Importance of Bio-molecules (nucleic acid, carbohydrates and proteins).

Plant Physiology and Metabolism: Ideas of Photosynthetic path ways (C₃, C₄ and CAM path way), Respiration, Photorespiration, transpiration and Photoperiodism (elementary ideas only), Phytohormones and their applications.

Plant Biotechnology: Introduction and application of plant tissue culture. Importance of plant breeding and basic concepts of hybridization.

Molecular biology: Preliminary ideas of Gene and gene cloning, elementary ideas of genetic engineering.

Bio-informatics: Introduction and applications.

Suggested Reading (MDC in Botany):

1. Medicinal Plants: Ethno botanical Approach. Trivedi P C, Agrobios, India.

3. স্নাতক উদ্ভিদবিদ্যা. জয়ন্ত কুমার শিকদার, কুণাল সেন, প্রণব গিরি; (সম্পাদনা দুলাল চন্দ্র সাঁতরা) সাঁতরা publication.

4. [ত্রি-বার্ষিক স্নাতক ব্যবহারিক উদ্ভিদবিদ্যা](#). ভূপেন্দ্র নাথ সান্যাল. নির্মলা লাইব্রেরী, কলকাতা.

2. Medicinal Plant Cultivation: A Scientific Approach, 2nd edn. Purohit and Vyas. Agrobios, India

Scheme and distribution of credits for 4 Year Under Graduate Degree (Minor) in Botany: Theory: 4 Credit; Practical: 2 Credit.

Scheme and distribution of credits for 4 Year Under Graduate Degree (MDC) in Botany: Total: 3 Credit.

Scheme and distribution of marks for 4 Year Under Graduate Degree (Minor) in Botany:

Theory: 50 marks; Practical: 25 marks. Internal Assessment: 20 marks; Attendance: 5 marks.

Scheme and distribution of marks for 4 Year Under Graduate Degree (MDC) in Botany:

Theory (MCQ): 35 marks; Internal Assessment: 10 marks; Attendance: 5 marks.

(For further details and clarification, please go to the university website to UG NCCF Regulation).

(Dr. Binod Chandra Sharma)

(Dr. Kishore Kumar Thapa)

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Date: 02.09.2026

(Dr. Debadin Bose]
Chairman; UG and PG BOS in Botany
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