4 yr. UG Degree Syllabus

According to NEP2023

(For the Colleges affiliated to Kazi Nazrul University, Asansol, West Bengal)

Subject- Botany (Single Major)

Semester - 1

Major Paper

Course Name: Plant Groups and Microbial World

Course Code: BSCBOTMJ101

L-T-P (3-0-4) Theory –15 (CA) and 35 (ESE), Total = 50

Course Type: **Core**	Course Details: **MJC-1**			L-T-P: **3-0-4**	
Credit: **3**	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	**15**	20	**35**

Course Learning Outcomes:

1. Combination of theoretical and practical components of this paper will provide comprehensive information and insight into the fascinating world of microbes and plants.
2. Hands on training will help students to learn use of microscope, various instruments handling, mounting, section-cutting and staining techniques for the study of bacteria and plant materials.
3. Making drawings in practical records will enhance understanding morphological and structural details and related functional aspects in diverse plant and microbial groups.
4. After the completion of the course the students will be able to develop understanding about the classification and diversity of different plants, microbes and their economic importance.
5. The students will develop conceptual skill about identifying plants and microbes.
6. The students will gain knowledge about developing commercial enterprise of the microbial products.

Detailed Syllabus -

Unit I: Plant Groups (Basic Concepts):

- Kingdom systems (*Two* kingdom, *Three* kingdom and *five* kingdom system), Classification of Plant Kingdom (By Eichler, 1883); Historical development of the discipline Botany (Contributions of Aristotle, Theophrastus, Dioscorides, Parasara, Sushruta, Charak, Carrolus Linnaeus, Engler and Prantl and Sir J.C Bose); General

and Comparative account of plant group; Scope and prospects in Botany (include Archaeobotany, Astrobotany and Dendrology also); Alternation of Generations and concept of gametophyte and sporophyte; Origin and evolution of life on planet Earth, Geological Time Scale and Major events of plant lives.

- General Features and Classification: Engler and Prantl's Classification (upto Classes); General characteristics and classification of groups upto classes (Aglae By Fritsch (1935), Fungi By Gwenny-Vaughani and Barnes (1937), Bryophytes by Proskauer (1957), Pteridophytes by Sporne (1965), Gymnosperm by Bierhorst (1971).
- General features, systematic position and life cycle of the genera – *Spirogyra, Mucor, Riccia, Pogonatum, Pteris* and *Pinus*. Methods of collection, preservation, storage and recording of each of these plant groups.
- Lichens: Classification, thallus organization, internal anatomy, reproduction; ecological and economic significance.
- Phytochemistry – Structures, classifications and physiological roles of Carbohydrates (excluding derivatives), proteins, amino acids, lipids, terpenes, phenolics and alkaloids; Concepts of optical isomerism (L and D form), mutarotation, Different types of bonds (Glycosydic bond, ester bond and peptide bond), Zwitterion and pI.

Unit II: Introduction to microbial world

- Historical development in the field of microbiology - (contributions of Antoni van Leuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch and A. Fleming); Microbes and their types.
- Polyphasic approaches in bacterial taxonomy, General idea about Bergey's Manual, Three domain system by C. Woese (1991).
- Microbial nutrition: nutritional types, growth and Reproduction of bacteria.
- Economic importance of bacteria with reference to their role in agriculture, fermentation industry and medicine (This will include only a general list of microbial products and the microorganisms involved).
- Medical Microbiology – Epidemiology, pathogenesis, causal organism and control of air borne disease (influenza), water borne disease (Cholera) and food borne disease (Staphylococcal food poisoning).

Unit III: Bacteria and Viruses

- General Bacteriology: Size, shape and arrangement of bacteria; Structures and functions of – Bacterial Capsule, flagella, pili, cell wall (chemical composition and

characteristics), plasma membrane, ribosomes, cytoplasmic inclusions, Plasmids and bacterial chromosome; endospore (structure, formation and germination).

- General characteristics of the domain Archaea and wall-less forms (Mycoplasmas, L-forms, Protoplasts and Spaheroplasts).
- Mechanism of gene transfer in bacteria: Transformation, Conjugation and Transduction.
- Viruses: General characteristics of viruses (size, symmetry, culture characteristics, general structure including concept of capsomere and peplomere, chemical composition).
- Structure of TMV, T_2 phage, HIV and SarsCov2.
- Viral multiplication – Lytic cycle and Lysogeny cycle (excluding regulation),
- Economic importance of viruses with reference to vaccine production, role in research, medicine and diagnostics anb as causal organisms of plant diseases.
- General characteristics and diseases due to Prions and Viroids.

Unit IV: Basic immunology (only outline) – Innate and acquired immunity, active and passive immunity, humoral (antibody mediated) and cellular (cell mediated) immunity, primary and secondary response, general structure of antibody and its types, Vaccines and their types.

Practical – 30 (CA) and 20 (ESE), Total = 50

- Microscopic examination of genera – *Spirogyra (*whole mount), *Mucor* (whole mount), *Riccia* (t,s of mature thallus), *Pogonatum* (l.s of Capsule), *Pteris* (t.s of mature leaf) and *Pinus* (t.s of needle and stem).
- Qualitative tests of carbohydrates (reducing, non-reducing sugar, starch (Molisch test, Fehling's test and Iodine test), protein (biuret test), lipid (Sudan III test) from natural sources.
- Demonstration of the functioning of Autoclave, Hot-air oven, Laminar air-flow, Filtration, Incubator and tools like inoculating loops/needles, petriplates, spreader, culture tubes etc.
- Preparation of standard bacteriological media (Nutrient agar and Nutrient broth).
- Demonstration of Sub-culturing technique.
- Enumeration of soil/food microorganisms by serial dilution technique.

- Microscopic examination of bacteria from natural habitats: curd and root nodules of leguminous plants (simple staining only)

Bibliography –

1. College Botany Vol. –II.- Gangulee and Kar, New Central Book Agency, Kolkata.
2. Studies in Botany, Vol. I. - Mitra, Mitra, Choudhury. Moulik Library, Kolkata.
3. Text Book of Botany, Voli-1, Hait, Ghosh and Bhattacharya, New Central Book Agency
4. Advanced Botany Vol-1 and Vol-2, By Sanjeev Pandey, Books and Allied (P) Ltd.
5. Morphology of Vascular Plants, By George H. M. Lawrence, 1951, Oxford & IBH Publishing Co.

Minor Paper

Course Name: Plant Groups and Microbial World

Course Code: BSCBOTMN101

L-T-P (3-0-4) Theory –15 (CA) and 35 (ESE), Total = 50

Course Type: **Core**	Course Details: **MNC-1**			L-T-P: **3-0-4**	
Credit: **3**	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	**15**	20	**35**

Syllabus same as Major

SEC (Skill Enhancement Course)

Course name: Mushroom technology

Course code – BSCBOTSE101

L-T-P = 2-1-0 (Theory: 15 (CA), 35 (ESE))

Course Type: **Core**	Course Details: **SEC-1**			L-T-P: **2-1-0**	
Credit: **3** **L-T-P=2-1-0**	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		-	**15**	-	**35**

Course Learning Outcomes:

On completion of this course, the students will be able to:

- Recall various types and categories of mushrooms.
- Demonstrate various types of mushroom cultivating technologies.
- Examine various types of food technologies associated with mushroom industry.
- Value the economic factors associated with mushroom cultivation
- Device new methods and strategies to contribute to mushroom production.

Detailed Syllabus -

Unit 1:

Introduction and history. Types of edible mushrooms available in India - *Volvariella volvacea*, *Pleurotus citrinopileatus*, *Agaricus bisporus*; Nutritional and medicinal value of edible mushrooms; Poisonous mushrooms.

Unit 2:

Methods of cultivation of edible mushrooms (Oyster, Button and Paddy straw mushrooms). Diseases of Mushroom fungi and methods of remedy. Methods of Mushroom span production. Equipments and Tools required for mushroom as well as spawn production.

Unit 3:

Storage and nutrition : Short-term storage (Refrigeration - upto 24 hours) Long term Storage (canning, pickels, papads), drying, storage in salt solutions. Nutrition - Proteins -
amino acids, mineral elements nutrition - Carbohydrates, Crude fibre content - Vitamins.

Unit 4:

Food Preparation: Types of foods prepared from mushroom. Research Centres - National level and Regional level. Cost benefit ratio - Marketing in India and abroad, Export Value.

Suggested Readings

1. Marimuthu, T. Krishnamoorthy, A.S. Sivaprakasam, K. and Jayarajan. R (1991) Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.

2. Swaminathan, M. (1990) Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.

3. Tewari, Pankaj Kapoor, S.C., (1988). Mushroom cultivation, Mittal Publications, Delhi.

4. Nita Bahl (1984-1988) Hand book of Mushrooms, II Edition, Vol. I & Vol. II.

ID/MD Paper -

Course name – Introduction to local flora

Course code:

Course Type: **Core**	Course Details: **MDC-1**			L-T-P: **3-0-0**	
Credit: **3**	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		-	**15**	-	**35**

Detailed Syllabus -

- What is Life? Criteria and features of life; Five kingdom concept.
- Plants groups, basic classification and general features of individual plant groups.
- Different types of ecological interaction among different plant groups. (Root nodules of legumes, Mycorrhiza, Parasitic Angiosperms).
- Ecological roles of Algae, Fungi, Bryophyta and vascular plants to maintain ecological balance and sustainability of ecosystem.
- Economic importance and future prospects of all plant groups; Traditional Knowledge about economic and medicinal use of important plants.
- Survey based Field study of local flora (Documentation and Report submission in the form of texts, photographs, tables and graphs).

Semester – 2

Paper Name: Cryptogamic Botany & Palaeobotany

Paper Code – BSCBOTMJ201

L-T-P (3-0-4) Theory –15 (CA) and 35 (ESE), Total = 50

Course Type: **Core**	Course Details: **MJC-2**			L-T-P: **3-0-4**	
Credit: **3**	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	**15**	20	**35**

Course Learning Outcomes:

1. Combination of theoretical and practical components of this paper will provide comprehensive information and insight into the fascinating world of

cryptogams and plant fossils.

2. After the completion of the course the students will be able to develop critical understanding on morphology, anatomy and reproduction of Algae, Bryophytes, Pteridophytes & Gymnosperms and also an understanding of the plant evolution and their transition to land habit.
3. The students will learn the major patterns of diversity among cryptogams along with their characters.
4. The students will develop an understanding by observation and table study of representative members of phylogenetically important groups to learn the process of evolution in a broad sense.
5. The students will understand morphology, reproduction and developmental changes therein through typological study and create a knowledge base in understanding the basis of lower group of extant plants and fossil members'. They will also get acquainted to the diversity and economic values of such plants.

Detailed Syllabus -

Unit I: Algae:

- Introduction; Habitat and distribution; thallus organization; origin and evolution of sex in algae.
- Criteria for algal classifications; Broad outline of classification of Lee (2008) up to family and its basis.
- Comparative account and evolutionary relationship of: Cyanophyceae, Chlorophyceae, Charophyceae, Xanthophyceae, Bacillariophyceae, Phaeophyceae, Rhodophyceae.
- Cell structure and reproduction of Cyanophyceae and Diatoms.
- Life histories of *Nostoc, Oedogonium*, *Chara*, *Vaucheria, Ectocarpus* and *Polysiphonia*.
- Economic importance of algae; Algal cultivation methods, Commercial cultivation and production of algal food.

Unit II: Bryology:

- Origin and phylogeny of Bryophytes; Habit and distribution; Broad outline of Classification of Giffinet (2009), Crandall-Stotler (2009) and Renzaglia (2007), Comparative study of Hepaticopsida, Anthocerotpoida and Bryopsida.

- Morphology, anatomy, reproduction and evolutionary trends of *Riccia, Marchantia, Pellia, Porella, Anthoceros, Sphagnum* and *Funaria*.
- Ecological and economic importance of bryophytes with special reference to *Sphagnum*.

Unit III: Pteridophytes- Introduction and Classification

- Introduction to Pteridophyta – Concept of Vascular Cryptogams; Land habit; stellar organization and its evolution; General features of Pteridophytes; Apogamy and apospory; Telome theory, Enation Theory.
- PPG1 (2016) classification of pteridophytes up to Suborder.
- Geological history and morphoanatomical and reproductive features of *Rhynia, Psilophyton* and *Zosterophyllum*; *Lepidodendron (Lepidodendron, Lepidocarpon), Calamites* (stem and strobilus-*Calamostachys* and *Palaeostachya*).
- Distribution, morphoanatomical and reproductive features of *Psilotum,. Lycopodium, Selaginella, Equisetum, Pteris* and *Marsilea.*

Unit IV – Palaeobotany

- Introduction to Palaeobotany – Important terminologies and definitions; Types of fossil on the basis of modes of preservation; Nomenclature, Conditions suitable for fossilization; Importance of fossils and their study; Stratigraphy – Law of superposition, Stratigraphic correlation and stratigraphic deduction based on megafossil and microfossil assemblages.

Practicals – 30(CA), 20 (ESE), Total = 50

- Micrometry-Standardization of compound microscope and measurement of cell size.
- Study of the vegetative and reproductive structures of the following genera using camera lucida: *Gloeotrichia, Scytonema, Zygnema, Oedogonium* and *Chara*.
- Study of the gametophytic and sporophytic structures of the following genera: *Riccia, Marchantia, Anthoceros and Funaria.*
- Study of external morphology and anatomical features of the following: *Lycopodium* (stem and strobilus), *Equisetum* (stem and strobilus) and *Marsilea* (Sporocarp).
- Macroscopic and microscopic identification of specimens of all genera included in the theoretical syllabus of Algae, Bryophytes and Pteridophytes.

- Study of the diagnostic features, geological time and mode of preservation of the following fossil members: *Lepidodendron*, (stem in T. S.), *Calamites* (stem in T. S.), *Bucklandia* (stem, specimen), *Glossopteris* (leaf, specimen), *Vertebraria* (root, specimen).
- Field Study: Specimen collection, identification and submission of collected and preserved materials with proper documentation.
- Preparation and Submission of permanent slides (with DPX/Canada balsam mount) of workout specimens.

Suggested Readings

1. College Botany Vol. –II.- Gangulee and Kar, New Central Book Agency, Kolkata.
2. Studies in Botany, Vol. I. - Mitra, Mitra, Choudhury. Moulik Library, Kolkata.
3. Text Book of Botany, Voli-1 and 2, Hait, Ghosh and Bhattacharya, New Central Book Agency.
4. Lee, R.E. (2008). Phycology, Cambridge University Press, Cambridge. 4th edition.
5. Vashishta B.R., Sinha A.K. and Singh V. P. (2008). Botany for Degree Students. Algae. S Chand and Co, New Delhi.
6. Vashishta B.R., Sinha A.K. and Singh V. P. (2008). Botany for Degree Students. Fungi. S Chand and Co, New Delhi.
7. Cryptoganic Botany Vol-1 By G. M. Smith
8. Algae By O.P. Sharma.
9. A Text Book of Botany: Lower Plants (2nd edition) Part-I: Bryophta. Singh, Pandey and Jain. 1999. Rastogi Publications. Merut.
10. A Text Book of Botany, Pandey, S. N., Trivedi, P. S. and Misra, S. P. 1989. VikasPublishing House Pvt. Ltd.
11. Bryophytes, a broad perspective. Puri, P. 1973. Atma Ram & Sons. New Delhi.
12. The structure and life of Bryophytes, Watson, E. V. Hutchinson University Library, London.
13. Cryptogamic Botany Vol. II. GM Smith,Bryophtes and Pteridophytes (2nd edition). Mc.Graw Hill Book Co. New York.
14. E. M. Gifford and A. S. Foster. 1988. Morphology and Evolution of Vascular Plants.
15. N. S. Parihar: An Introduction to Embryophyta Vol-I and II. Central Book. Allahabad.
16. K. R. Sporne : The Morphology of Pteridophytes. B. S. Publications. Calcutta

17. P. C. Vasistha. 1980 Botany for degree student Pteridophyta. S. Chand & Company Pvt. Ltd. Rashid. 1976. An Introduction to Pteridophyta. Vikas Publishing . New Delhi.
18. S. SundarRajan. 1994. An introduction to Pteridophyta. New Age International Publishing Limited and Willey Eastern Ltd.

Minor Paper -

Course Name: Cryptogamic Botany & Palaeobotany

Course Code: BSCBOTMN201

L-T-P (3-0-4) Theory –15 (CA) and 35 (ESE), Total = 50

Course Type: **Core**	Course Details: **MNC-2**			L-T-P: **3-0-4**	
Credit: **3**	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	**15**	20	**35**

Syllabus same as Major

SEC (Skill Enhancement Course)

Course name: Biofertilizer

Course code – BSCBOTSE201

L-T-P = 2-1-0 (Theory: 15 (CA), 35 (ESE))

Course Type: **Core**	Course Details: **SEC-2**			L-T-P: **2-1-0**	
Credit: **3** **L-T-P=2-1-0**	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		-	**15**	-	**35**

Course Learning Outcomes:

On the completion of this course, the students will be able to;

- Develop their understanding on the concept of bio-fertilizer
- Identify the different forms of biofertilizers and their uses
- Compose the Green manuring and organic fertilizers
- Develop the integrated management for better crop production by using both nitrogenous and phosphate bio fertilizers and vesicular arbuscular mycorrhizal

(VAM).

- Interpret and explain the components, patterns, and processes of bacteria for growth in crop production

Detailed Syllabus -

Unit-1:

- General account about the microbes used as biofertilizer; Isolation, mass production and application of Rhizobia, *Azospirillum* and *Azotobacter* as a biofertilizer; Actinorrhizal symbiosis (Organisms, hosts and general features).

Unit -2:

- General idea about Plant growth promoting rhizobacteria (PGPR) and Phosphate solubilizing bacteria (PSB); PGPR traits; Stress hormone Ethylene and PGPR.

Unit- 3:

- Cyanobacteria (blue green algae/ BGA) and *Azolla* as biofertilizer; Blue green algae and Azolla production; Application of BGA and *Azolla* in rice cultivation.

Unit -4:

- Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution; VAM fungi, and their influence on growth and yield of crop plants. (6 lectures)
- Organic farming – Green manuring and organic fertilizers; Organic Compost and Vermicompost - production and application.

Suggested Readings -

1. Dubey, R.C., 2005 A Text book of Biotechnology S.Chand & Co, New Delhi.

2. Kumaresan, V. 2005, Biotechnology, Saras Publications, New Delhi.

3. John Jothi Prakash, E. 2004. Outlines of Plant Biotechnology. Emkay Publication, New Delhi.

4. Sathe, T.V. 2004 Vermiculture and Organic Farming. Daya publishers.

5. Subha Rao, N.S. 2000, Soil Microbiology, Oxford & IBH Publishers, New Delhi.

6. Vayas,S.C, Vayas, S. and Modi, H.A. 1998 Bio-fertilizers and organic Farming Akta Prakashan, Nadiad

ID/MD Paper -

Course name – Plant Health and Plant Protection

Course code:

Course Type: **Core**	Course Details: **MDC-2**			L-T-P: **3-0-0**	
Credit: **3**	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		-	**15**	-	**35**

Detailed Syllabus -

- General idea about the common plant diseases of your area caused by fungi, bacteria, virus, mycoplasmas and nematodes; Its economy and management. (Includes identification of the host plant, name of the disease caused and name of the associated causal organisms only).
- Post harvest and storage related losses due to activities of fungi, bacteria, and other organisms. Economy and management.
- Integrated approach in controlling diseases during cultivation and also post harvest time.
- Definitions and examples of common weeds, alien species and invasive species; Adverse effects and control measures.
- Survey based Field study of plant diseases and weeds types. Documentation and report submission in the form texts, Photography, Tables and graphs etc.)

NB:

VAC:

Course name - Herbarium Techniques & Museology

(Syllabus will be designed later)