

SYLLABUS

**DERGAON KAMAL DOWERAH COLLEGE (AUTONOMOUS)
FOUR YEARS UNDER GRADUATE PROGRAMME (FYUGP)**

[AS PER NEP 2020)



BOTANY

(Recommended by Board of studies in Botany, D.K.D.C. (Autonomous), in its meeting held on 12.05.2026 and approved by the Academic Council meeting held on 30.06.2026 and effective from 2026-2027)

1. THE PREAMBLE:

As recommended by Board of Studies and approved by the Academic Council of Dergaon Kamal Dowerah College (Autonomous), the Department of Botany works to implement the relevant components of New Education Policy (NEP), 2020 for Four Years Under Graduate Programme (FYUGP) under Choice Based Credit System (CBCS). The following facts are taken into consideration when designing the basic structure of the FYUGP :

- a) Flexibility to switch between disciplines of study
- b) Opportunity for learners to select the courses of their interest across all disciplines
- c) Flexible entry and exit options with UG certificates, UG diplomas, or Bachelor degrees depending on the number of credits earned
- d) Flexibility for students to switch between institutions so they can engage in multi-and/or interdisciplinary learning
- e) Flexibility to switch to alternative modes of learning
- f) Knowledge required for self-employment initiatives and entrepreneurship mindset
- g) Ability for complex critical thinking and real-life problem solving
- h) Capability to understand global issues, multicultural competence and digital literacy
- i) Capable on research skills, communication skills, community-based engagement, environment awareness, responsibility and accountability

2. INTRODUCTION:

The Four Years Under Graduate Programme (FYUGP) syllabus of Botany in light of NEP-2020, consists of Major (MJ) disciplines, Minor (MN) disciplines, Multi-Disciplinary Generic Elective Courses (GEC), Ability Enhancement Courses (AEC), Value Added Courses (VAC), Skill Enhancement Courses (SEC), Research Methodology (RM), Dissertation (D) (Collection of Data, Analysis and Preparation of Report) and Major Electives (MJE).

The FYUGP degree programme offers certificates, diplomas and degrees as follows:

UG Certificate: Certificate course consists of two Major disciplines, two Minor disciplines, two GEC, two AEC, two VAC and two SEC.

UG Diploma: Diploma course consists of eight Major disciplines, four Minor disciplines, three GEC, two AEC, three VAC, three SEC.

3-year UG Degree: 3-year UG degree course consists of fifteen Major disciplines, six Minor disciplines, three GEC, two AEC, three VAC, three SEC, Internship/Community (NCC/NSS/Adult Education/Student mentoring/ NGO/ Govt. Institutions, etc.)/Project

4-year Honours Degree: 4-year honours degree course consists of twenty Major disciplines, eight Minor disciplines, three GEC, two AEC, three VAC, three SEC, Internship/Community (NCC/NSS/Adult Education/Student mentoring/ NGO/ Govt. Institutions, etc.)/Project, Research Methodology (RM), Dissertation/ two DSE.

3. AIMS OF FYUGP IN BOTANY:

- a. To introduce the students with the rich biodiversity of North east India
- b. To enable the students to explore the potential of plant resources for human welfare and their use in a sustainable way
- c. To develop capabilities of students for critical evaluation of contemporary issues related to environment and nature
- d. To generate skilled human resource for biological entrepreneurship

4. GRADUATE ATTRIBUTES OF THE FYUGP IN BOTANY:

Disciplinary Knowledge

The graduates should have the ability to demonstrate comprehensive knowledge and understanding of both the theoretical and applied components of plant science and allied areas of study in a multidisciplinary context. Students should have the ability to connect relevant disciplines, and recent trends in biological and contemporary issues.

Communication Skills

The graduates in Botany should have the ability to present and express information, thoughts, experiments and results clearly and concisely for effective communication of any issues related to plant and nature.

Moral and Ethical Awareness/Reasoning

Ability to recognize ethical issues that are pertinent to one's work and pledge not to engage in unethical behavior such as plagiarism, copyright and infringement of intellectual property rights; ability to appreciate recent developments in various fields and one's research with honesty and integrity in all aspects.

Multicultural Competence

Ability to correlate and compare recent developments in various branches of plant science worldwide; ability to collaborate research in various fields of biology with other researchers from allied organizations; acquisition of knowledge on traditional practices of different ethnic communities.

Information/Digital Literacy

The graduates of Botany should have the ability to utilize Information and Communications Technology (ICT) tools, biological databases and computer and software in solving biological problems.

Reflective Thinking and Problem Solving

After completion of graduation in Botany the students will be able to understand the value of plant resources, need for conservation of plant resources, bio-prospecting and sustainable utilization of plant resources for human welfare.

Critical Thinking

The graduates of Botany should be competent for critical analysis of problems related to plant and nature, sustainable uses of biological resources and their conservation strategies.

5. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

- 1) Formulate strategies to achieve sustainable development in harnessing biological resources.
- 2) Evaluate environmental problems and design innovative solutions.
- 3) Demonstrate an attitude to employ multidisciplinary approaches for problem solving.

6. PROGRAMME OUTCOMES (POs)

- 1) Develop ideas to assess and inventorize existing biological resources of this region
- 2) Formulate innovative strategies for conservation of biogenetic resources for human welfare
- 3) To explore and validate ethnobiological knowledge of Northeast India
- 4) To provide solutions for existing societal problems using biological knowledge

- 5) Develop research skills to solve complex biological issues and achieving SDGs
- 6) Execute good communication skills for disseminating knowledge of biological sciences
- 7) To promote the attitude to work as a team appreciating ethical values

7. PROGRAMME SPECIFIC OUTCOMES (PSOs)

- 1) Evaluate the diversity and evolution of organisms
- 2) Analyze the fundamentals of life-sustaining processes
- 3) Design strategies for issues concerning public health and human welfare
- 4) Critically analyze the environmental issues and develop strategies to address them
- 5) Formulate measures to mitigate climate change effects

STRUCTURE OF FOUR YEARS UNDER GRADUATE PROGRAMME (FYUGP) AS PER NEP-2020 IN BOTANY FOR DERGAON KAMAL DOWERAH COLLEGE (AUTONOMOUS)

Semester	Course with paper code	Nature of course	Title of the paper	Credit
I	BOT1MJ01	Major	Algae, Fungi, Bryophyte & Pteridophyte	4
	BOT1MN01	Minor	Algae, Fungi, Bryophyte & Pteridophyte	4
	BOT1GEC1	GEC	Natural resource management	3
	AEC1A/AEC1B	AEC	Any One: AEC1A: Assamese/ AEC1B: Alternative English	4
	VAC1A/VAC1B	VAC	Any One: VAC1A: Understanding India/ VAC1B: Health and Wellness	2
	SEC1BOT01	SEC	Tea plantation and management	3
		Total credit		20
II	BOT2MJ01	Major	Morphology and Reproduction of Spermatophytes	4
	BOT2MN01	Minor	Morphology and Reproduction of Spermatophytes	4
	BOT2GEC1	GEC	Plant Diversity and Human Welfare	3
	AEC2	AEC	Language and Communication Skills (English) II	4
	VAC2	VAC	Environmental Education	2
	SEC2BOT02	SEC	Biofertilizers	3
		Total credit		20

	UG CERTIFICATE	

Syllabus of FYUGP in Botany

**Department of Botany
DKD College (Autonomous)**

Semester-I

Course Title : Algae, Fungi, Bryophyte & Pteridophyte
Course : Major
Course Code : BOT1MJ01
Total Credits : 04
Marks : 100 [End: 60 (Theory: 45, Practical: 15), In: 40]

Course Outcomes:

1. Describe different groups of the plant kingdom like algae, fungi, bryophyte and pteridophyte
2. Organize the organisms into different categories based on their morphological, anatomical and reproductive characteristics
3. Analyze the interrelationships among different species and genera within each group of plants

Learning Outcomes:

1. Understand the various groups in the plant kingdom up to pteridophytes
2. Classify various organisms based on their morphology, anatomy and reproduction
3. Compare and interpret relationships among different groups of plants

Mapping of CO with Bloom's taxonomy

Knowledge Dimension	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual						
Conceptual		CO1, CO2		CO2, CO3		
Procedural						
Metacognitive						

Mapping of Course outcomes to Programme outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Average
CO1	3	2	3	2	3	2	2	2.4
CO2	3	2	3	2	2	2	2	2.2
CO3	3	2	3	1	3	2	1	2.1

Average	3	2	3	1.6	2.6	2	1.6	
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3 for highest correlation, 2 for moderate correlation, 1 for lowest correlation

Modes of internal assessment:

1. One internal examination (Theory)
2. One internal examination (Practical)
3. Viva-voce/Group discussion
4. Home assignments

Attainment strategies of COs:

1. Continuous evaluation through in and end-semester theory and practical examinations
2. Field collection and identification of specimens
3. Submission of collected specimens
4. Practical record book

COURSE CONTENT

Total lectures: 60

Unit 1: Algae

(13 lectures; 10 marks)

General characteristics, range of thallus organization, cell structure, pigment system, reproduction, classification (Fritsch system of classification), Characteristic features of Cyanophyceae, Chlorophyceae, Xanthophyceae, Pheophyceae and Rhodophyceae. Morphology and life cycle of *Anabaena*, *Chara*, *Ectocarpus* and *Polysiphonia*. Diatoms and their importance; role of algae in the environment, agriculture, biotechnology and industry

Unit 2: Fungi

(16 lectures; 12 marks)

Salient features, classification (Alexopolus and Mims, 1979), thallus organization, nutrition and reproduction of fungi. Life cycles of *Penicillium*, *Agaricus* and *Puccinia*. Mycorrhiza: types and significance; Lichen: characteristic features, types, internal structure, and reproduction; ecological and economic importance of fungi and lichen

Unit 3: Bryophytes

(12 lectures; 08 marks)

General features, classification and thallus organization of bryophytes. Morphology, anatomy and reproduction of *Marchantia*, *Anthoceros* and *Polytrichum*; evolutionary trends in bryophytes. Ecological and economic importance of bryophytes

Unit 4: Pteridophytes

(12 lectures; 10 marks)

General features and classification of pteridophytes. Morphology, anatomy and reproduction of *Selaginella*, *Equisetum* and *Marsilea*. Heterospory and seed habit, stelar organization and evolution, affinities of pteridophytes

Unit 5: Introduction to Indian Knowledge System with Reference to Cryptogams

(7 lectures; 5 marks)

Components, characteristics and scopes of IKS; indigenous uses of cryptogams in traditional medicine, food and agriculture with special reference to North East India

Lab activities

1. Study of vegetative and reproductive structures of *Chara*, *Ectocarpus* and *Polysiphonia*
2. Study of vegetative and reproductive structures of *Penicillium*, *Agaricus* and *Puccinia*
3. Study of vegetative and reproductive structures of *Marchantia*, *Anthoceros* and *Polytrichum*
4. Study of vegetative and reproductive structures of *Selaginella/Lycopodium* and *Equisetum/Marsilea*.
5. Collection and submission of local specimens

Suggested Readings

1. Mitra J.N., Mitra D., Chaudhuri S.K. Studies in Botany, Volume One (2018), Moulik Library. Kolkata, India.
2. Pandey B.P. College Botany, Volume-1. (2011). S. Chand. Delhi, India.
3. Vashishta B. R, Sinha A.K., Singh V.P., (2016). Botany for Degree Students, Algae. S. Chand. Delhi, India.
4. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley & Sons (Asia) Singapore. 4th edition
5. Vashishta, P.C., Sinha, A.K., Kumar, A. (2010). Pteridophyta. S. Chand. Delhi, India
6. Webster, J. and Weber, R. (2007). Introduction to Fungi, Cambridge University Press, Cambridge. 3rd edition.
7. Vashishta B. R, Sinha A.K., Kumar A., Botany for Degree Students, Bryophyta. S. Chand. Delhi, India. Revised addition.
8. Hait G., A Textbook of Mycology. New Central Book Agency, India. 1st Edition.

Semester-I

Course Title	: Algae, Fungi, Bryophyte & Pteridophyte
Course	: Minor
Course Code	: BOT1MN01
Total Credits	: 04
Marks	: 100 [End: 60 (Theory: 45, Practical: 15), In: 40]

Course Outcomes:

1. Describe different groups of the plant kingdom like algae, fungi, bryophyte and pteridophyte
2. Organize the organisms into different categories based on their morphological, anatomical and reproductive characteristics
3. Analyze the interrelationships among different species and genera within each group of plants

Learning Outcomes:

1. Understand the various groups in the plant kingdom up to pteridophytes
2. Classify various organisms based on their morphology, anatomy and reproduction
3. Compare and interpret relationships among different groups of plants

Mapping of CO with Bloom's taxonomy

Knowledge Dimension	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual						
Conceptual		CO1, CO2		CO2, CO3		
Procedural						
Metacognitive						

Mapping of Course outcomes to Programme outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Average
CO1	3	2	3	2	3	2	2	2.4
CO2	3	2	3	2	2	2	2	2.2
CO3	3	2	3	1	3	2	1	2.1
Average	3	2	3	1.6	2.6	2	1.6	

3 for highest correlation, 2 for moderate correlation, 1 for lowest correlation

Modes of internal assessment:

5. One internal examination (Theory)
6. One internal examination (Practical)
7. Viva-voce/Group discussion

8. Home assignments

Attainment strategies of COs:

5. Continuous evaluation through in and end-semester theory and practical examinations
6. Field collection and identification of specimens
7. Submission of collected specimens
8. Practical record book

Course content

Total lectures: 60

Unit 1: Algae

(13 lectures; 10 marks)

General characteristics, range of thallus organization, cell structure, pigment system, reproduction, classification (Fritsch system of classification), Characteristic features of Cyanophyceae, Chlorophyceae, Xanthophyceae, Pheophyceae and Rhodophyceae. Morphology and life cycle of *Anabaena*, *Chara*, *Ectocarpus* and *Polysiphonia*. Diatoms and their importance; role of algae in the environment, agriculture, biotechnology and industry

Unit 2: Fungi

(16 lectures; 12 marks)

Salient features, classification (Alexopolus and Mims, 1979), thallus organization, nutrition and reproduction of fungi. Life cycles of *Penicillium*, *Agaricus* and *Puccinia*. Mycorrhiza: types and significance; Lichen: characteristic features, types, internal structure, and reproduction; ecological and economic importance of fungi and lichen

Unit 3: Bryophytes

(12 lectures; 08 marks)

General features, classification and thallus organization of bryophytes. Morphology, anatomy and reproduction of *Marchantia*, *Anthoceros* and *Polytrichum*; evolutionary trends in bryophytes. Ecological and economic importance of bryophytes

Unit 4: Pteridophytes

(12 lectures; 10 marks)

General features and classification of pteridophytes. Morphology, anatomy and reproduction of *Selaginella*, *Equisetum* and *Marsilea*. Heterospory and seed habit, stelar organization and evolution, affinities of pteridophytes

Unit 5: Introduction to Indian Knowledge System with Reference to Cryptogams

(7 lectures; 5 marks)

Components, characteristics and scopes of IKS; indigenous uses of cryptogams in traditional medicine, food and agriculture with special reference to North East India

Lab activities

6. Study of vegetative and reproductive structures of *Chara*, *Ectocarpus* and *Polysiphonia*
7. Study of vegetative and reproductive structures of *Penicillium*, *Agaricus* and *Puccinia*
8. Study of vegetative and reproductive structures of *Marchantia*, *Anthoceros* and *Polytrichum*
9. Study of vegetative and reproductive structures of *Selaginella/Lycopodium* and *Equisetum/Marsilea*.
10. Collection and submission of local specimens

Suggested Readings

1. Mitra J.N., Mitra D., Chaudhuri S.K. Studies in Botany, Volume One (2018), Moulik Library. Kolkata, India.
2. Pandey B.P. College Botany, Volume-1. (2011). S. Chand. Delhi, India.
3. Vashishta B. R, Sinha A.K., Singh V.P., (2016). Botany for Degree Students, Algae. S. Chand. Delhi, India.
4. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley & Sons (Asia) Singapore. 4th edition
5. Vashishta, P.C., Sinha, A.K., Kumar, A. (2010). Pteridophyta. S. Chand. Delhi, India
6. Webster, J. and Weber, R. (2007). Introduction to Fungi, Cambridge University Press, Cambridge. 3rd edition.
7. Vashishta B. R, Sinha A.K., Kumar A., Botany for Degree Students, Bryophyta. S. Chand. Delhi, India. Revised addition.
8. Hait G., A Textbook of Mycology. New Central Book Agency, India. 1st Editio

Semester I

Title of the Course: Biofertilizers

Nature of course: SEC

Course code: BOT1SEC1

Total credits: 03

Marks: 75 [End:45 (Theory: 25, Practical: 20), In: 30]

Course outcomes:

1. Describe biofertilizers and their importance
2. Analyze the strategies for mass production of biofertilizer
2. Implementation of organic cultivation using biofertilizers

Learning outcomes:

1. Identify microbes that can be used as biofertilizers
2. Understand and implement the strategies for biofertilizer production
3. Analyze the issues involved in organic agriculture

Mapping of CO with Bloom's taxonomy

Knowledge Dimension	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual						
Conceptual		CO1, CO3		CO2, CO3		
Procedural		CO2	CO2			
Metacognitive						

Mapping of Course outcomes to Programme outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Average
CO1	3	2	2	3	2	2	2	2.2
CO2	3	3	2	2	2	2	2	2.2
CO3	3	2	2	2	2	2	2	2.1
Average	3	2.3	2	2.3	2	2	2	

3 for highest correlation, 2 for moderate correlation, 1 for lowest correlation

Modes of internal assessment:

1. One internal examination (theory)
2. Viva-voce/Group discussion
3. Home assignments

Attainment strategies of COs:

1. Continuous evaluation through in and end-semester theory and practical
2. Field visit
3. Field study report

Course Content**Total lectures: 45****Unit 1: Plant growth and nutrients:****(05 lectures; 03 marks)**

Plant growth, factors affecting plant growth; role of micro and macronutrients in plant growth

Unit 2: Biofertilizer-a general account**(10 lectures; 06 marks)**

Definition, types of biofertilizer-based on function (nitrogen-fixing, phosphate, phosphorus and mineral solubilizing) and microbes (bacterial, fungal, algal); plant growth promoting Rhizobacteria (PGPR); importance and application of biofertilizer, biocontrol agents and their types

Unit 3: Biological nitrogen fixation and mass production of biofertilizer**(12 lectures; 08 marks)**

Mechanism of biological nitrogen fixation; Cyanobacteria (blue green algae), *Azolla* and *Anabaena* association and their role in rice cultivation. Isolation and mass production of *Rhizobium* as biofertilizer

Unit 4: Mycorrhizae**(08 lectures; 03 marks)**

Mycorrhizal association: types of mycorrhizal association; VAM, colonization, role of mycorrhiza on growth and yield of crop plants

Unit 5: Organic farming

(10 lectures; 05 marks)

Organic fertilizers, green manure; biocompost- vermicompost, liquid manure; application of bio compost, advantages and disadvantages of organic fertilizers

Practical/lab activities

1. Demonstration/field visit to biofertilizer producing units
2. Identification of some common biofertilizers
3. Isolation and mass production of biofertilizer

Suggested Readings

1. Sharma, D., Upadhyaya, S. & Pegu, M.N., 2024. Fundamentals of Biofertilizers, White Falcon Publishing, Chandigarh, India.
2. Dubey, R.C., 2005 A Text book of Biotechnology S.Chand& Co, New Delhi.
3. Kumaresan, V. 2005, Biotechnology, Saras Publications, New Delhi.
4. John Jothi Prakash, E. 2004. Outlines of Plant Biotechnology. Emkay Publication, New Delhi.
5. Sathe, T.V. 2004 Vermiculture and Organic Farming. Daya publishers.
6. Subha Rao, N.S. 2000, Soil Microbiology, Oxford & IBH Publishers, New Delhi.
7. Vayas, S.C, Vayas, S. and Modi, H.A. 1998 Bio-fertilizers and organic Farming, Akta Prakashan, Nadiad

Semester I
Title of the Course: Natural Resource Management
Nature of course: GEC
Course code: BOT1GEC1
Total Credits: 03
Marks: 75 [End: 45, In: 30]

Course outcome:

1. Distinguish between renewable and non-renewable resources
2. Analyze threats to natural and biological resources of NE India
3. Examine management strategies for sustainable utilization of resources

Learning outcome:

1. Differentiate natural and biological resources of NE India
2. Identify the threats and issues related to the natural resources
3. Assess the effectiveness of various management strategies in achieving sustainability

Mapping of CO with Bloom's taxonomy

Knowledge Dimension	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual						
Conceptual		CO1, CO3		CO2, CO3		
Procedural						
Metacognitive						

Mapping of Course outcomes to Programme outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Average
CO1	3	2	2	2	2	2	2	2.1
CO2	3	2	3	2	2	2	2	2.3
CO3	3	2	2	2	3	2	2	2.3
Average	3	2	2.3	2	2.3	2	2	

3 for highest correlation, 2 for moderate correlation, 1 for lowest correlation

Modes of internal assessment:

1. One internal examination (theory)
2. Viva-voce/Group discussion
3. Home assignments

Attainment strategies of COs:

Continuous evaluation through in and end-semester theory.

Course content**Total lectures: 45****Unit 1: Natural resources:****(08 lectures; 08 marks)**

Natural resources; definition and types. Renewable and non-renewable natural resources. Natural resources of India with special reference to NE India

Unit 2: Sustainable utilization of land and water resources:**(15 lectures; 15 marks)**

Sustainable utilization of land, degradation and management. Sustainable utilization of water resources; rainwater harvesting, ground water recharge. Wetlands of Assam, their importance and conservation.

Unit 3: Forest and its conservation:**(12 lectures; 12 marks)**

Definition, forest types of Assam and its importance; forest degradation: causes and consequences; afforestation and reforestation; important timber yielding plants of Assam; non-timber forest products (NTFPs) and concept of Joint Forest Management (JFM)

Unit 4: Contemporary practices in resource management:**(10 lectures; 10 marks)**

EIA, participatory resource appraisal, concept of carbon footprint, resource accounting; waste management, role of GIS and GPS in conservation

Suggested readings:

1. Vasudevan, N. (2006). Essentials of Environmental Science. Narosa Publishing House, New Delhi.
2. Singh, J. S., Singh, S.P. and Gupta, S. (2006). Ecology, Environment and Resource Conservation. Anamaya Publications, New Delhi.
3. Sharma, P.D. (2009). Ecology and Environment, Rastogi publications, Meerut, India

Semester-II

Title of the Course: Morphology and Reproduction of Spermatophytes

Nature of course: Major

Course code: BOT2MJ01

Total Credits: 04

Marks: 100 [End: 60 (Theory: 45, Practical: 15), In:40]

Course outcomes:

1. Describe different groups of gymnosperms and angiosperms
2. Examine the morphology and reproductive processes in gymnosperms and angiosperms
3. Analyze the interrelationship among different species and genera of gymnosperms and angiosperms

Learning Outcomes:

1. Understand the various groups in gymnosperms and angiosperms
2. Distinguish various groups in gymnosperms and angiosperms based on their morphology and reproduction
3. Compare and interpret relationships among different species and genera of gymnosperms and angiosperms

Mapping of CO with Bloom's taxonomy

Knowledge Dimension	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual						
Conceptual		CO1, CO2, CO3		CO1, CO2, CO3		
Procedural						
Metacognitive						

Mapping of Course outcomes to Programme outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Average
CO1	3	2	3	2	2	2	2	2.2
CO2	3	2	2	2	2	2	2	2.1
CO3	3	2	3	2	2	2	2	2.2
Average	3	2	2.3	2	2	2	2	

3 for highest correlation, 2 for moderate correlation, 1 for lowest correlation

Modes of internal assessment:

1. One internal examination (Theory)
2. One internal examination (Lab)
3. Viva-voce/Group discussion
4. Home assignments

Attainment strategies of COs:

1. Continuous evaluation through in and end-semester theory and practical examinations
2. Field collection and identification of specimens
3. Submission of collected specimens
4. Practical record book

Course content**Total Lectures: 60****Unit 1: Gymnosperms****(08 lectures; 10 marks)**

General characteristics, classification. Morphology, anatomy and reproduction of *Cycas*, *Ginkgo* and *Gnetum*; Patterns of embryo development in gymnosperms. Ecological and economic importance

Unit 2: Paleobotany**(06 lectures; 7 marks)**

Process of fossilization; types of fossil plants; morphology and anatomy of *Rhynia*, *Sphenophyllum* and *Cycadeoidea*; Geological time scale; importance of fossil study

Unit 3: Floral morphology of angiosperm**(07 lectures; 10 marks)**

Morphology of flower (inflorescence, flower). Anther, anther wall structure; morphology of pollen grain, wall structure, pollen wall proteins; pollen viability, storage and germination, classification (NPC system) of pollen grains. Structure and types of ovules

Unit 4: Reproduction in angiosperm

(18 lectures; 13 marks)

Microsporogenesis; Pollination: types, significance and adaptations; microgametogenesis, megasporogenesis (monosporic, bisporic and tetrasporic) and megagametogenesis. Double fertilization; structure and types of embryos and endosperm; embryo-endosperm relationship; polyembryony, apomixes and parthenocarpy, self-incompatibility

Unit 5: Indian Knowledge System with reference to Spermatophytes

(07 lectures; 05 marks)

Aspects of IKS in gymnosperm and angiosperm conservation; sacred groves, ritualized harvesting, beliefs and taboos. Spermatophytes in traditional medicine with special reference to NE India

Lab activities

1. Study of morphology and reproductive parts of *Cycas* & *Gnetum* (temporary slide preparation).
2. Study of fossil plants (Photographs/slide).
3. Study of different types of inflorescences.
4. Study of different types of ovules (permanent / temporary slides)
5. Study of pollen morphology and pollen germination (temporary slide preparation)
6. Histochemical test on pollen viability
7. Study of types of embryos and endosperms (Permanent slides/ photographs)

Suggested readings

1. Bhatnagar, S.P. & Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
2. Bhojwani, S.S. and Bhatnagar, S.P. (2011). The Embryology of Angiosperms, Vikas Publishing House. Delhi. 5th edition.
4. Mitra J.N., Mitra D., Chaudhuri S.K. Studies in Botany, Volume One (2018), Moulik Library. Kolkata, India.
5. Pandey B.P. College Botany, Volume-1. (2011). S. Chand. Delhi, India.
6. Bhattacharya K., Hait G., Ghosh A.K., A Text Book of Botany, Volume-II. (2011). NCBA

Semester-II

Title of the Course: Morphology and Reproduction of Spermatophytes

Nature of course: Minor

Course code: BOT2MN01

Total Credits: 04

Marks: 100 [End: 60 (Theory: 45, Practical: 15), In:40]

Course outcomes:

1. Describe different groups of gymnosperms and angiosperms
2. Examine the morphology and reproductive processes in gymnosperms and angiosperms
3. Analyze the interrelationship among different species and genera of gymnosperms and angiosperms

Learning Outcomes:

1. Understand the various groups in gymnosperms and angiosperms
2. Distinguish various groups in gymnosperms and angiosperms based on their morphology and reproduction
3. Compare and interpret relationships among different species and genera of gymnosperms and angiosperms

Mapping of CO with Bloom's taxonomy

Knowledge Dimension	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual						
Conceptual		CO1, CO2, CO3		CO1, CO2, CO3		
Procedural						
Metacognitive						

Mapping of Course outcomes to Programme outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Average
CO1	2	3						
CO2	2	3						
CO3	2	3						
Average	2	3						

3 for highest correlation, 2 for moderate correlation, 1 for lowest correlation

Modes of internal assessment:

1. One internal examination (Theory)
2. One internal examination (Lab)
3. Viva-voce/Group discussion
4. Home assignments

Attainment strategies of COs:

1. Continuous evaluation through in and end-semester theory and practical examinations
2. Field collection and identification of specimens
3. Submission of collected specimens
4. Practical record book

Course content**Total Lectures: 60****Unit 1: Gymnosperms****(08 lectures; 10 marks)**

General characteristics, classification. Morphology, anatomy and reproduction of *Cycas*, *Ginkgo* and *Gnetum*; Patterns of embryo development in gymnosperms. Ecological and economic importance

Unit 2: Paleobotany**(06 lectures; 07 marks)**

Process of fossilization; types of fossil plants; morphology and anatomy of *Rhynia*, *Sphenophyllum* and *Cycadeoidea*; Geological time scale; importance of fossil study

Unit 3: Floral morphology of angiosperm**(07 lectures; 10 marks)**

Morphology of flower (inflorescence, flower). Anther, anther wall structure; morphology of pollen grain, wall structure, pollen wall proteins; pollen viability, storage and germination, classification (NPC system) of pollen grains. Structure and types of ovules

Unit 4: Reproduction in angiosperm

(18 lectures; 13 marks)

Microsporogenesis; Pollination: types, significance and adaptations; microgametogenesis, megasporogenesis (monosporic, bisporic and tetrasporic) and megagametogenesis. Double fertilization; structure and types of embryos and endosperm; embryo-endosperm relationship; polyembryony, apomixes and parthenocarpy, self-incompatibility

Unit 5: Indian Knowledge System with reference to Spermatophytes

(07 lectures; 05 marks)

Aspects of IKS in gymnosperm and angiosperm conservation; sacred groves, ritualized harvesting, beliefs and taboos. Spermatophytes in traditional medicine with special reference to NE India

Lab activities

1. Study of morphology and reproductive parts of *Cycas* & *Gnetum* (temporary slide preparation).
2. Study of fossil plants (Photographs/slide).
3. Study of different types of inflorescences.
4. Study of different types of ovules (permanent / temporary slides)
5. Study of pollen morphology by acetolysis method
6. Study of pollen germination (temporary slide preparation)
6. Histochemical test on pollen viability
7. Study of types of embryos and endosperms (Permanent slides/ photographs)

Suggested readings

1. Bhatnagar, S.P. & Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
2. Bhojwani, S.S. and Bhatnagar, S.P. (2011). The Embryology of Angiosperms, Vikas Publishing House. Delhi. 5th edition.
4. Mitra J.N., Mitra D., Chaudhuri S.K. Studies in Botany, Volume One (2018), Moulik Library. Kolkata, India.
5. Pandey B.P. College Botany, Volume-1. (2011). S. Chand. Delhi, India.
6. Bhattacharya K., Hait G., Ghosh A.K., A Text Book of Botany, Volume-II. (2011).

Semester-II
Title of the Course: Tea plantation and management
Nature of course: SEC
Course code: BOT2SEC1
Total Credits: 03
Marks: 75 [End: 45 (Theory: 25, Practical: 20), In: 30]

Course outcome:

1. Distinguish between different tea species and varieties
2. Analyze threats to tea plantation and management
3. Examine management strategies of small gardens
4. Analyze the market demand of tea

Learning outcomes:

1. Differentiate the tea species available in Assam
2. Identify the issues related to tea plantation management
3. Execute management strategies for small tea gardens
4. Understand the economics of tea production

Mapping of CO with Bloom's taxonomy

Knowledge Dimension	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual						
Conceptual		CO1, CO2, CO4	CO3	CO1, CO2, CO3, CO4		
Procedural						
Metacognitive						

Mapping of Course outcomes to Programme outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Average
CO1	3	2	2	2	2	2	2	2.1
CO2	2	2	1	2	2	2	2	1.8
CO3	2	2	2	3	1	2	2	2
CO4	2	2	1	3	2	1	1	1.7
Average	2.2	2	1.5	2.5	1.75	1.75	1.75	

3 for highest correlation, 2 for moderate correlation, 1 for lowest correlation

Modes of internal assessment:

1. One internal examination (theory)
2. Viva-voce/Group discussion
3. Home assignments

Attainment strategies of COs:

1. Continuous evaluation through in and end-semester theory and practical
2. Field visit
3. Field study report

Course Content**Total lectures: 45****Unit 1: History, taxonomy and ecology****(13 lectures; 07 marks)**

History of tea cultivation; taxonomy and morphology of tea plant. Climatic (light, temperature, rainfall, humidity) and edaphic factors (organic matter, pH, soil nutrients) for tea cultivation

Unit 2: Cultivation and management**(15 lectures; 10 marks)**

Propagation techniques of tea-vegetative propagation, seed propagation; nursery management; selection of planting sites, land preparation, plant spacing and staking, manuring, pruning, tipping and plucking; irrigation; weed and pest control; tea disease and control measures; shade tree. Organic tea cultivation

Unit 3: Production, processing and marketing**(17 lectures; 08 marks)**

Production and processing of tea: black tea, green tea and white tea; chemistry of tea manufacture; tea quality; tea grades; storage of tea; herbal tea. Health benefits of tea; cost of cultivation and processing; employment generation; importance of tea in national economy

Practical/lab activities

1. Field visit to tea nursery, tea gardens, and tea processing units of nearby area
2. Identification and documentation of weeds of tea gardens
3. Demonstration of tea propagation techniques
4. Submission of tea disease album
5. Examine made tea varieties

Suggested readings

1. The Planters' Handbook, published by Tocklai Experimental Station, Tea Research Association, Jorhat-785008, Assam, India
2. Science and practice in Tea culture, D. N. Barua, Published by TRA, Tocklai Experimental Station, Jorhat-785008, Assam, India
3. Tea Cultivation in the Plains of North East India by A. P. Das, S. E. Kabir, Regency Publications

Semester-II
Title of the course: Plant Diversity and Human Welfare
Nature of course: GEC
Course code: BOT2GEC1
Total Credits: 03
Marks: 75 [End: 45, In: 30]

Course outcomes:

1. Differentiate the level of plant diversity
2. Understand the scopes of plant ecology
3. Analyze the causes and impacts of biodiversity loss
4. Evaluate the role of plants in human welfare

Learning outcomes:

1. Distinguish the biodiversity levels
2. Analyze threats to biodiversity
3. Understand the conservation strategies for biodiversity
4. Examine the role of plants in human welfare

Mapping of CO with Bloom's taxonomy

Knowledge Dimension	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual						
Conceptual		CO1, CO2, CO4		CO3	CO4	
Procedural						
Metacognitive						

Mapping of Course outcomes to Programme outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Average
CO1	3	2	2	2	2	2	2	
CO2	3	2	2	2	2	2	2	
CO3	3	3	2	1	1	2	2	
CO4	3	2	3	2	1	1	1	
Average	3	2.2	2.2	1.7	1.2	1.7	1.7	

3 for highest correlation, 2 for moderate correlation, 1 for lowest correlation

Modes of internal assessment:

1. One internal examination (theory)
2. Viva-voce/Group discussion
3. Home assignments

Attainment strategies of COs:

Continuous evaluation through in and end-semester theory.

Course Content

Total lectures: 45

Unit 1: Introduction to plant diversity

(12 lectures; 10 marks)

Classification of plants, plant habits, plant habitats (terrestrial and aquatic), structural and physiological adaptations of plants (xerophytic, hydrophytic, epiphytic, halophytic), importance of plant diversity

Unit 2: Plant ecology and Ecosystem

(12 lectures; 10 marks)

Environmental factors, importance of plants in environment. Definition, type and scope of plant ecology, structure and function of ecosystem, types of ecosystems

Unit 3: Economic botany

(11 lectures; 12 marks)

Medicinal and aromatic plants (MAPs), ornamental plants, oil yielding plants, fibre yielding plants, dye yielding plants, rubber, spices, beverages, millets. Traditional home state economy

Unit 4: Biodiversity and conservation

(10 lectures; 13 marks)

Levels of biodiversity: genetic, species, and ecosystem diversity, Biodiversity loss: causes, consequences and impacts, man-animal conflicts with special reference to Assam. *Ex-situ* and *in-situ* conservation

Suggested readings

1. Kumar, U. and Asija M., second edition 2004, Biodiversity- principles and conservation, Agrobios (India).
2. Krishnamurthy, K.V. (2004). An Advanced Text Book of Biodiversity - Principles and Practices. Oxford and IBH Publications Co. Pvt. Ltd. New Delhi.
3. Saha T.K. (2011), Ecology and Environmental Ecology, Books and Allied (P) Ltd., Kolkata, India
4. Smith T.M. and Smith R.L. 2008, Elements of Ecology, Dorling Kindersley (India) Pvt. Ltd.
5. Ambasht R.S. and Ambasht N.K. 15th edition, 2008, A textbook of plant ecology. CBS publishers
6. Dash M.C. and Dash S.P. 3rd edition, 2009, Fundamentals of ecology. MacGraw Hills