NORTH LAKHIMPUR UNIVERSITY
DEPARTMENT OF BOTANY
SYLLABUS OF POST GRADUATE PROGRAMME
(As per NEP 2020)
MSc in BOTANY

As approved by Board of Studies in Botany held on 09.06.2026

DEPARTMENT OF BOTANY
NORTH LAKHIMPUR UNIVERSITY
KHELMATI, NORTH LAKHIMPUR - 787031
LAKHIMPUR, ASSAM
2026-27

1.0 Introduction

The Department of Botany was established in 1966 and is dedicated to excellence in teaching and research, focusing on a wide range of disciplines. With expertise in areas of plant sciences, the department offers students a comprehensive education in both theoretical and practical aspects of Botany. Programmes like Post graduate (MSc) are designed to foster critical thinking, research skills and a deep understanding of plant biology. The department is equipped with state-of-the art laboratory facilities, supporting advanced research opportunities for students.

Botany is the scientific study of plants including their structure, properties and how they interact with the environment. This is a branch of science requiring theory as well as practical oriented knowledge. The model curriculum has a multidisciplinary approach keeping in mind The New Education Policy 2020. It helps to develop skills to empower the cadre required towards innovation, incubation and entrepreneurship along with professional and employable skills. The practical or hands on experience with Project work/internship/fieldwork would help and build capacities for conducting different research activities among the students. The curriculum has been structured to prepare the undergraduates to achieve skills to move forward with the development of the society/community/nation and entrepreneurship in particular. The course curriculum encompasses multidimensional fundamental, core and aspects of ability enhancement, skill enhancement and various disciplines with Graduate Attributes (GAs) such as theoretical knowledge, recent trends, technological equipment, disciplinary knowledge, laboratory/field driven practical's, self-learning, critical thinking, analytical and problem solving abilities, use of ICT, application of knowledge, lifelong learning, research-related skills, team spirit, multicultural competencies, leadership qualities, developing moral and social values, fundamental rights and duties, gender equality, maintaining balanced personality, career counselling, global vision, professional commitment and sensitizing with Sustainable Development Goals (SDGs) of United Nations. It also aims to build a society based on human values**.**

1.1 Nature and extent of the M.Sc (Botany)

The curriculum in Botany is an outcome based framework designed on the expected learning outcomes and to meet the academic standards. The key outcomes that help curriculum planning at the Post Graduate level include Graduate Attributes, Qualifications Descriptors, Programme Learning Outcomes (PLO) and Course level Learning Outcomes (CLO). The overall objectives of the learning outcomes-based curriculum framework are to:

- Maintain national standards and international comparison of learning outcomes and academic standards to ensure global competitiveness, and to facilitate student/graduate mobility;
- Help formulate graduate attributes, qualification descriptors, programme learning outcomes and course learning outcomes that are expected to be demonstrated by the holder of a qualification;
- Enable prospective students, parents, employers and others to understand the nature and level of learning outcomes (knowledge, skills, attitude and values) or attributes a graduate of a programme should be capable of demonstrating on successful completion of the programme of study.
- Provide higher education institutions an important point of reference for designing teaching-learning strategies, assessing student learning levels, and periodic review of programmes and academic standards.

1.3 Aim of Master's degree Programme in Botany

- To decipher the basic and applied knowledge in all the major domains of Botany and its allied areas.
- To develop competency in application of knowledge i.e. theory and practical aspects.
- To impart knowledge and develop skills for professional life.
- To create professionals in different related areas, foster research and development, teaching, government and public service and entrepreneurship as well.

1.4 Graduate Attributes

- ❖ Graduate attributes are fostered through meaningful learning experiences made available through the updated curriculum, and a process of critical and reflective thinking.
- ❖ The graduate attributes reflect the particular quality and feature or characteristics of an individual, including the knowledge, skills, attitudes and values that are expected to be acquired by a graduate of M.Sc Botany through studies at the higher education institution (HEI).
- ❖ The graduate attributes for the post graduate students pursuing MSc Botany Programme include capabilities that help them to strengthen their abilities for widening current knowledge base and skills, gaining new knowledge and skills in the areas like Plant diversity and taxonomy, cytology and genetics, tools and techniques in Biology, plant breeding, morphology and reproduction of Spermatophytes, microbiology, plant pathology, anatomy of angiosperms, embryology, plant systematics, ecology, plant physiology, plant metabolism, molecular biology, phytogeography, plant biotechnology, research methodology, evolution and speciation, environmental biology and biodiversity conservation.
- ❖ The graduate attributes reflect the particular quality and feature or characteristics of an individual, including the knowledge, skills, attitudes and values that are expected to be acquired by a graduate of M.Sc Botany through studies at the higher education institution (HEI).

Few characteristics attributes of graduates of MSc Botany Programme include:

1. ***Reflective thinking:*** Capable of identifying appropriate resources required for a project, and manage a project through to completion, while observing responsible and ethical scientific conduct.
2. ***Digital Literacy***: Competency in accessing relevant and authentic information and data from Electronic media with a motive to learn .
3. ***Disciplinary knowledge and skills:*** Capable in demonstrating basic theoretical and practical knowledge and understanding
4. ***Communication Skills :*** Ability to communicate precisely, confidently and with clarity.
3. ***Critical thinking, Analytical reasoning and Problem solving:*** Ability to employ critical thinking in identifying the problem, developing analytical skills and capabilities to resolve the problems efficiently.
4. ***Research and Scientific reasoning:*** Skills in undertaking small researches by way of project paper, Case Studies, Field visits, Laboratory Experiments etc.
5. ***Team Player:*** Capability of working enthusiastically and united with the working teams in organizing events in the classroom, outside the classroom, laboratory and extension activities etc.

6. ***Self-directive learning:*** Potential to complete the assigned projects successfully either at Residential / Commercial level or Community level by managing the resources independently and wisely.

7. **Multicultural competence:** Ability to learn about different structures and patterns in world perspective.

8. ***Moral and Ethical awareness/reasoning:*** Development of a sense of moral responsibility and values by practising awareness programme or field activities.

9. ***Leadership readiness/ qualities:*** Persuasion to imbibe leadership skills by providing hands of experience to exercise the leadership skill.

10. ***Lifelong Learning:*** Motivation to be updated regularly and consistently throughout the life.

1.5 Qualification Descriptors

- The qualification descriptors indicate the common academic standards for the qualification and help the degree-awarding bodies in designing, approving, assessing and reviewing academic programmes.
- The learning experiences and assessment procedures are expected to be designed to provide every student with the opportunity to achieve the intended programme learning outcomes.
- A qualification descriptor of MSc Botany programme indicates the generic outcomes and graduate attributes expected for the award of theMaster's degree with Honours in Botany.
- The qualification descriptors also describe the academic standard for a specific qualification in terms of the levels of knowledge and understanding, skills and competencies and attitudes and values that the holders of the qualification are expected to attain and demonstrate in terms of actual outputs.
- The qualification descriptors reflect disciplinary knowledge, professional skills. The students who will complete three years of full–time study of a post graduate programme of study of Botany will be awarded Master's Degree with Honours.

1.6 Course learning Outcome

1.7 Programme Specific Outcome (PSO)/Course learning Outcome

PSO1: Core Knowledge & Conceptual Understanding

Demonstrate in-depth knowledge and understanding of advanced concepts in plant biology, systematics, molecular biology, physiology, ecology, and biotechnology.

PSO2: Critical Thinking and Problem Solving

Analyze complex biological systems and interpret scientific data to solve real-world problems related to agriculture, environment, and plant biotechnology using logical reasoning and scientific methodology.

PSO3: Application and Research Competence

Apply botanical principles in experimental design, laboratory techniques, and fieldwork to develop innovative solutions in areas such as sustainable agriculture, climate change mitigation, and biodiversity conservation.

PSO4: Communication Skills

Communicate scientific ideas clearly and effectively through oral, written, and digital formats, using appropriate terminology, data visualization tools, and presentation techniques for both academic and non-

academic audiences.

PSO5: Individual and Team Work
Work effectively both independently and in multidisciplinary teams, demonstrating leadership, collaboration, and time management in research projects, seminars, and field studies.

PSO6: Ethics and Professional Responsibility
Demonstrate ethical conduct and integrity in scientific research, data handling, publication, and in the application of botanical knowledge for societal benefit.

PSO7: Environment and Sustainability
Evaluate environmental challenges and advocate sustainable practices by integrating ecological principles and plant-based solutions to support environmental health and resource conservation.

PSO8: Lifelong and Self-Directed Learning
Engage in continuous learning through self-study, critical reading of scientific literature, and participation in research and professional development programs.

PSO9: Design and Innovation Mindset
Develop a design-thinking approach to address botanical and ecological challenges, incorporating creativity and innovation in projects related to plant science and biotechnology.

PSO10: Computational and Data Literacy
Utilize computational tools, bioinformatics, and statistical methods for modeling biological processes, analyzing plant genome data, and managing biodiversity information.

PSO11: Effective Citizenship and Global Perspective
Demonstrate awareness of global and national botanical issues, and contribute as informed and responsible citizens to policy-making, conservation, and education.

PSO12: Aesthetic and Cultural Engagement
Appreciate the aesthetic value of plant life and integrate traditional botanical knowledge with modern science, promoting cultural heritage and sustainable living.

1.8 Teaching Learning Methodologies

Various teaching-learning methodology used in the Under-Graduate courses of Botany are as follows:

- **Lecture method:** The lecture method is a teaching style in which the instructor conveys a topic to students through a structured presentation. In this approach, the teacher primarily speaks while students listen and take notes.

- **Chalkboard:** Chalkboards are used by the teacher for a gradual progression from basic to more advanced concepts and also to incorporate diagrams, symbols, charts and to make immediate adjustments during the lesson.

- **Smart board and projector method**: These teaching aids combine both visual and auditory elements to effectively communicate information, concepts, and ideas to students in the form of slideshows, videos, animations, interactive presentations etc.

- **Demonstration:** The demonstration method of teaching involves the teacher performing a task in front of the class, allowing students to observe and learn how to do it themselves.
- **Practical and Experimentation (lab-based):** This learning method emphasizes hands-on experience and real-world application rather than just theoretical knowledge. It encourages

students to learn through active involvement, allowing them to engage directly with the subject matter.

- **Experimentation (field-based):** It involves the study of plant species in the field, where they are found, why they are found there, and where else they might occur.
- **Internship:** Internships are temporary programs aimed at giving students practical experiences to work with experienced professionals, improve skills, learn about industry practices, and build professional network.
- **Seminars and presentations:** Classroom seminars and National seminars are organized to provide the students opportunity to participate in methods of scientific analysis and research procedures.
- **Tutorials:** Tutorials are small group sessions intended to support lectures and are typically more relaxed in format.
- **Educational excursions and field trips:** Educational excursions and field trips are trips or outings organized for learning purposes, where students visit locations outside the classroom to gain hands-on experience and explore topics related to their studies.
- **Institute and research lab visits:** During an institute visit, students may explore different academic programs, facilities, and meet faculty members. A lab visit focuses on giving students the opportunity to observe experiments, research projects, and scientific practices in action, providing them with practical insight into their field of study.
- **Project-based Learning Pedagogy:** It is an approach that emphasizes reflective practice and collaboration, allowing students to link concepts to real-life situations.
- **ICT and web based sources:** Use of ICT and web based sources is highly recommended to make the teaching learning process interactive and interesting.

1.9 Assessment and Outcome Measurement Methods

A variety of assessment methods that are appropriate within the disciplinary area of Botany will be used.

- Oral and written examinations,
- closed-book and open-book tests;
- problem-solving exercises,
- practical assignment, observation of practical skills,
- individual project reports,
- seminar presentation;
- viva voce
- project activities,
- surprise and sudden tests,
- group discussion
- home assignments.

2.0 Certification Criteria

- **PG Certificate**: Students completing the programme after securing 80 credits will be awarded PG course completion Certificate in the relevant discipline/subject.

2.1 Other Key Criteria for PG Programme

- A dissertation (6 credits) shall have to be submitted in the PG 4th semester in partial fulfillment of requirements for the degree of MSc in Botany.

Summary of the PG Course Structure as per NEP Guidelines
Department of Botany
Structure of Syllabus

Course Categories: **CC:** Core Course, **DS**: Discipline Specific Elective Course, **RM**: Research Methodology, **IN**: Internship, RP: Research Project, DIS: Dissertation.

Course Transaction Categories: **L:** Lecture; **T:**Tutorial**; P:** Practical

Evaluation Categories: **IA:** Internal Assessment; **ES:** End Semester Examination

SEMESTER I

Course	Course Title	Course Code	CREDIT	MARKS	ES	IA	L	T	P
M.Sc.	Plant Biochemistry	CC-4-MBOT-101	3 (T)+1(P)	60+20	42	18	3	0	1
	Cytogenetics	CC-4-MBOT-102	3 (T)+1(P)	60+20	42	18	3	0	1
	Tools and Techniques in Biology	CC-4-MBOT-103	3 (T)+1(P)	60+20	42	18	3	0	1
	Taxonomy of Angiosperms – I	EC-4-MBOT-101A	3 (T)+1(P)	60+20	42	18	3	0	1
	Cytogenetics & Plant Breeding – I	EC-4-MBOT-101B	3 (T)+1(P)	60+20	42	18	3	0	1
	Plant Ecology – I	EC-4-MBOT-101C	3 (T)+1(P)	60+20	42	18	3	0	1
	Tissue Culture	OC-4-MBOT-101	4(T)	80	56	24	3	1	0
TOTAL CREDIT				**20**					

SEMESTER II

Course	Course Title	Course Code	CREDIT	MARKS	ES	IA	L	T	P
M.Sc.	Microbiology	CC-4-MBOT-201	3 (T)+1(P)	60+20	42	18	3	0	1
	Research Methodology	CC-4-MBOT-202	3 (T)+1(P)	60+20	42	18	3	0	1
	Biostatistical Tools	CC-4-MBOT-203	3 (T)+1(P)	60+20	42	18	3	0	1
	Taxonomy of Angiosperms – II	EC-4-MBOT-201A	3 (T)+1(P)	60+20	42	18	3	0	1
	Cytogenetics & Plant Breeding – II	EC-4-MBOT-201B	3 (T)+1(P)	60+20	42	18	3	0	1
	Plant Ecology – II	EC-4-MBOT-201C	3 (T)+1(P)	60+20	42	18	3	0	1
	Internship/Community engagement	IN-4-MBOT-201	4	80	This course should be completed during vacation (30 days)				
TOTAL CREDIT				**20**					

SEMESTER III

Course	Course Title	Course Code	CREDIT	MARKS	ES	IA	L	T	P
M.Sc.	Microbiology and Plant Pathology	CC-4-MBOT-301	3 (T)+1(P)	60+20	42	18	3	0	1
	Molecular Biology	CC-4-MBOT-302	3 (T)+1(P)	60+20	42	18	3	0	1
	Evolution, Speciation and Plant Breeding	CC-4-MBOT-303	3 (T)+1(P)	60+20	42	18	3	0	1
	Taxonomy of Angiosperms – III	EC-4-MBOT-301A	3 (T)+1(P)	60+20	42	18	3	0	1
	Cytogenetics & Plant Breeding – III	EC-4-MBOT-301B	3 (T)+1(P)	60+20	42	18	3	0	1
	Plant Ecology – III	EC-4-MBOT -301C	3 (T)+1(P)	60+20	42	18	3	0	1
	Field Research Project (Community Service)	RP-4-MBOT-301	4	80	0	0	0	0	0
TOTAL CREDIT				**20**					

SEMESTER IV

Course	Course Title	Course Code	CREDIT	MARKS	ES	IA	L	T	P
M.Sc.	Biotechnology	CC-4-MBOT-401	3 (T)+1(P)	60+20	42	18	3	0	1
	Environmental Biology and Biodiversity Conservation	CC-4-MBOT-402	3 (T)+1(P)	60+20	42	18	3	0	1
	Principles of Ethnobotany	CC-4-MBOT-403	2(T)	40	28	12	2	0	0
	Taxonomy of Angiosperms – IV	EC-4-MBOT-401A	3 (T)+1(P)	60+20	42	18	3	0	1
	Cytogenetics & Plant Breeding – IV	EC-4-MBOT-401B	3 (T)+1(P)	60+20	42	18	3	0	1
	Plant Ecology – IV	EC-4-MBOT-401C	3 (T)+1(P)	60+20	42	18	3	0	1
	Dissertation	DIS-6-MBOT-401	6	120	0	0	0	0	0
TOTAL CREDIT				**20**					

i) *Only one Elective Course (EC) should be selected in the 1st Semester and will be continued to 4th Semester.*

ii) *For Dissertation, option selected in 1st Semester will be continued in 4th Semester.*

iii) *Field study can be made in any semester as per convenience.*

SEMESTER I

Course Code: CC-4-MBOT-101
Course Title: Biochemistry
Nature of the Course: Core Course
Component of the course: L-2, T-1, P-1
Total Credit Assigned = 4

Course	Title	Credit	Marks	ES	IA	L	T	P
CC-101	Biochemistry	3+1=4	60(T)+20(P)	42	18	45	3	1

Distribution of credits: **Lecture: 45** **Practical: 00** **Tutorial: 3**
Distribution of Marks: **Full Marks = 60** **End Semester= 42** **In Semester: 18**

Course Contents

Unit	Content	Marks	L	P	T
1	**Carbohydrates:** Monosaccharides - structure of aldoses and ketoses, ring structure of sugars, conformations of sugars, mutarotation, anomers, epimers and enantiomers, structure of biologically important sugar derivatives. Formation of disaccharides, reducing and non- reducing disaccharides. Polysaccharides – homo- and heteropolysaccharides, structural and storage polysaccharides. Structure and role of proteoglycans, glycoproteins and glycolipids.	14	15	0	**1**
2	**Proteins and Enzymes:** Structure and properties of amino acids; physical and chemical properties of proteins; different level of structural organization of proteins. Nomenclature and classification of enzymes, active sites; lock and key model and induced-fit model; factors affecting enzyme activity; activation energy; allosteric regulation; enzyme inhibition-competition, non-competitive and uncompetitive; cofactors; prosthetic groups; enzyme kinetics; ribozymes.	14	15	**0**	**1**
3	**Lipids and Nucleic acids:** Classification and properties of fatty acids; saturated and unsaturated fatty acids; essential fatty acids; phospholipids; glycolipids; steroids. Storage lipids - triacyl glycerol and waxes. Nucleic acids: nucleosides and nucleotides; purines and pyrimidines, types of nucleic acids; physical and chemical properties of nucleic acids.	14	15	**0**	**1**
Total		**42**	**45**	**00**	**03**

Practical

Content
1. Qualitative test for carbohydrate, lipid, amino acids & proteins 2. Separation of amino acids by chromatography 3. Assay of proteins using Lowry method, standard curve preparation

(L = Lecture, P = Practical, T = Tutorial)

Mode of Transaction: Lecture Cum Discussion, Seminars, Workshops, Group discussion, Seminars, Self Study and Library Work.

Mode of In-Semester Assessment:

A. Sessional Test: **Marks: 20 + 20**

B. Other Sessional Activities: **Marks: 10**

In- Semester Assessment **Marks: 18**

A.Sessional Activity

1. Activities selected from above mentioned list:

a) Lecture cum Discussion b) Seminars, Workshops c) Group discussion d) Self Study and Library Work.

SEMESTER-I

Course Code: CC-4-MBOT-102

Course Title: Cytogenetics

Nature of the Course: Core Course

Component of the course: L-2, T-1, P-1

Total Credit Assigned = 4

Course	Title	Credit	Marks	ES	IA	L	T	P
CC-102	Cytology and Genetics	3+1=4	60(T)+20(P)	42	18	45	3	1

Distribution of credits: **Lecture: 45** **Practical: 00** **Tutorial: 3**

Distribution of Marks: **Full Marks = 60** **End Semester= 42** **In Semester: 18**

Course Contents

Unit	Contents	Marks	L	P	T
1	**Cell Biology:** Molecular organization of plasma membrane; Membrane lipids & Membrane fluidity, Membrane transport: diffusion, facilitated diffusion, active transport; Carriers & Channel Proteins; Electrical properties of plasma membrane; Dynamics of microfilaments, Role of actin & microtubule cytoskeleton in cell shape, intracellular motility, mitosis & locomotion	10	12	0	1
2	Cellular communication: cell adhesion and roles of different adhesion molecules; Cell signalling; signalling molecules, receptors, second messengers, mechanism of signal transduction, Programmed cell death	8	10	0	
3	**Genetics:** Cell theory and exceptions, Chromosome structure and organization, specialized chromosomes and their cytogenetic significance, chromatin structure, nucleosome, chromosome banding and painting, mitotic apparatus, Synaptenemal complex, concept of karyotype and idiogram.	10	10	0	1
4	Polygenic inheritance: concept, examples of inheritance of kernel colour of wheat, corolla length in tobacco, Monogenic vs polygenic inheritance.	7	8	0	1
5	Genetical control of sex: Chromosomal basis of sex determination, balanced theory of sex determination, environmental and hormonal control of sex, concept of sex linked, sex limited and sex influenced characters.	7	5	0	
Total		**42**	**45**	**0**	**3**

Practical

1	**Genetics:** 1. Preparation of materials and study of somatic chromosomes of some common plants, camera lucida drawing and karyotype preparation. 2. Collection of flower buds and study of meiosis of some common plants.

(L = Lecture, P = Practical, T = Tutorial)

Mode of Transaction: Lecture Cum Discussion, Seminars, Workshops, Group discussion, Seminars, Self Study and Library Work.

Mode of In-Semester Assessment:

A. Sessional Test:	**Marks: 20 + 20**
B. Other Sessional Activities:	**Marks: 10**
In- Semester Assessment	**Marks: 18**

A. Sessional Activity

a) Discussion
b) Seminars, Workshops
c) Group discussion
d) Self Study and Library Work.

Suggested Readings:

Gardner, R. J. M., Sutherland, G. R., & Shaffer, L. G. (2017). *Chromosome abnormalities and genetic counseling* (5th ed.). Oxford University Press.

Singh, R. J. (2016). *Plant cytogenetics* (3rd ed.). CRC Press.

Klug, W. S., Cummings, M. R., Spencer, C. A., & Palladino, M. A. (2018). *Concepts of genetics* (12th ed.). Pearson.

De Robertis, E. D. P., & De Robertis, E. M. F. (2006). *Cell and molecular biology* (8th ed.). Lippincott Williams & Wilkins.

Karp, G. (2018). *Cell and molecular biology: Concepts and experiments* (8th ed.). Wiley.

Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2014). *Molecular biology of the cell* (6th ed.). Garland Science.

Griffiths, A. J. F., Wessler, S. R., Carroll, S. B., & Doebley, J. (2020). *Introduction to genetic analysis* (12th ed.). W. H. Freeman.

Klug, W. S., Cummings, M. R., Spencer, C. A., & Palladino, M. A. (2019). *Concepts of genetics* (12th ed.). Pearson.

Pierce, B. A. (2020). *Genetics: A conceptual approach* (7th ed.). Macmillan Learning.

SEMESTER-I

Course Code: CC-4-MBOT-103

Course Title: Tools and Techniques in Biology

Nature of the Course: Core Course

Component of the course: L-2, T-1, P-1

Total Credit Assigned = 4

Course	Title	Credit	Marks	ES	IA	L	T	P
CC-103	Plant Ecology and Phytogeography	3+1=4	60(T)+20(P)	42	18	45	3	1

Course Contents

Unit	Content	Marks	L	P	T
1	**Imaging and related techniques** Principles of microscopy; Light microscopy; Fluorescence microscopy; Confocal microscopy, Transmission and Scanning electron microscopy – sample preparation for electron microscopy, cryofixation, negative staining, shadow casting, freeze fracture, freeze etching. Use of fluorochromes: (a) Flow cytometry (FACS); (b) Applications of fluorescence microscopy: Chromosome banding, FISH, chromosome painting.	12	13	0	1
2	**Separation techniques** Centrifugation: Differential and density gradient centrifugation, sucrose density gradient, $CsCl_2$gradient, analytical centrifugation, ultracentrifugation, marker enzymes. **Chromatography** Principle; Paper chromatography; Column chromatography, TLC, GLC, HPLC, Ion-exchange chromatography.	10	10	0	1
3	**Radioisotopes** Principle and use of auto-radiography, Geigor-Muller counter.	6	4	0	
4	**Spectrophotometry** Principle and its application in biological research.	6	8	0	1
5	**Characterization of proteins and nucleic acids** Mass spectrometry; X-ray diffraction; Characterization of proteins and nucleic acids; Electrophoresis: AGE, PAGE, SDS-PAGE.	8	10	0	
Total		42	45	00	03

Practical

Unit	Content
1	1. Separation of Amino Acid by TLC. OR Separation of N_2 base by Paper Chromatography. 2. Ray Diagram. OR Sample preparation for electron Microscopy. 3. Demonstration Instruments/Photographs. 4. Practical Record Book. 5. Viva-Voce.

(L = Lecture, P = Practical, T = Tutorial)

Mode of Transaction: Lecture Cum Discussion, Seminars, Workshops, Group discussion, Seminars, Self Study and Library Work.

Mode of In-Semester Assessment:

A.Sessional Test: **Marks: 20+20**

B.Other Sessional Activities: **Marks: 10**

In- Semester Assessment **Marks: 18**

A. Sessional Activity

1. Activities selected from above mentioned list:

a) Lecture cum Discussion
b) Seminars, Workshops
c) Group discussion
d) Self Study and Library Work.

Suggested readings

1. Plummer, D.T. (1996). An Introduction to Practical Biochemistry. Tata McGraw-Hill Publishing Co. Ltd. New Delhi. 3rd edition.

2. Ruzin, S.E. (1999). Plant Microtechnique and Microscopy, Oxford University Press, New York. U.S.A.

3. Zar, J.H. (2012). Biostatistical Analysis. Pearson Publication. U.S.A. 4th edition.

1st Semester
M.Sc. BOTANY
SEMESTER-I
Course Code: EC-4-MBOT-101A
Course Title: Taxonomy of Angiosperms-I

Nature of the Course: Elective Course
Component of the course: L-2, T-1, P-1
Total Credit Assigned = 4

Course	Title	Credit	Marks	ES	IA	L	T	P
EC-101A	Taxonomy of Angiosperms-I	3+1=4	60(T)+20(P)	42	18	45	3	1

Theory

Distribution of credits: **Lecture: 45** **Practical: 00** **Tutorial: 3**
Distribution of Marks: **Full Marks = 60** **End Semester= 42** **In Semester: 18**

Course Contents

Unit	Contents	Marks	L	P	T
1	**Basics of Taxonomy**: Concept, Aims and Principles, Components of Taxonomy, Objectives of Taxonomy, Alpha and Omega taxonomy; Concept of Phenetic, Phyletic, and Phylogenetic classification; Classificatory Systems: Pre- and Post Darwinian Classifications, Recent development of classificatory system in Angiosperms- APG System (APG I, II, III & IV).	10	11	0	1
2	Origin and Evolution**:** Characteristic features of early Angiosperms; Origin of Angiosperms, Primitive and advanced angiosperms; Evolutionary trends in Angiosperms	6	6	0	
3	Terminology used in Taxonomic Description of Angiospermic Plants, How to describe an Angiospermic plant, Floral Formula and Floral Diagram.	6	6	0	1
4	Concept of Taxa; Concept of Species, Genus, Family and Infra specific categories.	6	6	0	
5	Botanical Nomenclature: History, Principles and Major rules, Typification, Effective and Valid Publication, Authors' citation, Principles of Priority and Limitations, synonym, basionym, nomina conservanda, rejection of names, illegitimate names, nomennudum, tautonym, later homonym	7	8	0	1
6	**Process of Identification**: Herbarium techniques: Methods of Collection, Identification and Documentation; Roles and importance of herbaria, Botanical Gardens and Museums in taxonomic studies, Major Herbaria and Botanic Gardens in World and India.	7	8	0	
Total		**42**	**45**	**0**	**3**

Practical

Unit	Contents
1	Field study (Phytogeographically Biodiversity reached different areas in Assam and Arunachal Pradesh), Collection, Photography, processing of plant specimens for herbarium, preservation and submission of field report.)

(L = Lecture, P = Practical, T = Tutorial)

Mode of Transaction: Lecture Cum Discussion, Seminars, Workshops, Group discussion, Seminars, Self Study and Library Work.

Mode of In-Semester Assessment:

A. Sessional Test: **Marks: 20 + 20**

B. Other Sessional Activities: **Marks: 10**

In- Semester Assessment **Marks: 18**

A. Sessional Activity

a) Discussion
b) Seminars, Workshops
c) Group discussion
d) Self Study and Library Work.

Suggested Readings:

Singh V., Pande P.C. and Jain D.K. (2017). A textbook of Botany. Angiosperms. Rastogi Publications. Fourth edition. Meerut. New Delhi, 110055.

Sharma O.P. (2021). Plant Taxonomy. Tata McGraw-Hills publishing company limited, 4/12 Asaf Ali Road, New Delhi 110002.

Baruah A. (2000). A textbook of plant systematics. Kalyani publishers New Delhi.

Pullaiah T, S and Karuppusamy. (2018). Regency Publications (Publication)Taxonomy Of Angiosperms 4th Revised Edn (English,Hardback).

Singh, G. (2019). *Plant systematics: An integrated approach* (4th ed.). CRC Pr.

Judd, W. S., Campbell, C. S., Kellogg, E. A., Stevens, P. F., & Donoghue, M. J. (2015). *Plant systematics: A phylogenetic approach* (4th ed.). Sinauer Associates.

Heywood, V. H., Brummitt, R. K., Culham, A., & Seberg, O. (2007). *Flowering plant families of the world.* Royal Botanic Gardens, Kew.

1st Semester

M.Sc. BOTANY
SEMESTER-I
Course Code: EC-4-MBOT-101B
Course Title: Cytogenetics & Plant Breeding-I

Nature of the Course: Elective Course
Component of the course: L-2, T-1, P-1
Total Credit Assigned = 4

Course	Title	Credit	Marks	ES	IA	L	T	P
EC-101B	Cytogenetics & Plant Breeding – I	3+1=4	60(T)+20(P)	42	18	45	3	1

Theory

Distribution of credits: **Lecture: 45** **Practical: 00** **Tutorial: 3**
Distribution of Marks: **Full Marks = 60** **End Semester= 42** **In Semester: 18**

Course Contents

Unit	Contents	Marks	L	P	T
1	Cell theory and exceptions, Chromosome structure and organization, specialized chromosomes and their cytogenetic significance, chromatin structure, nucleosome, chromosome banding and painting, mitotic apparatus, Synaptenemal complex, concept of karyotype and ideogram	10	11	0	1
2	Polygenic inheritance: concept, examples of inheritance of kernel colour of wheat, corolla length in tobacco, Monogenic vs polygenic inheritance.	8	9	0	1
3	Genetical control of sex: Chromosomal basis of sex determination, balanced theory of sex determination, environmental and hormonal control of sex, concept of sex linked, sex limited and sex influenced characters.	8	9	0	
4	Breeding systems: modes of reproduction in crop plants, important achievements and undesirable consequences of plant breeding.	8	8	0	1
5	Breeding for disease and insect resistance, Types of genetic resistance, vertical and horizontal resistance, mechanism of disease and insect resistances, factors or genes of resistance.	8	8	0	
Total		**42**	**45**	**0**	**3**

Practical

Unit	Contents
1	Preparation of fixatives and stains used in cytological works, killing and fixing of tissue and organs and their preservative, use of pretreatment for chromosome spreading.
2	Preparation of smears and squashes from pollen mother cells and root tips using suitable staining techniques.
3	Studies on some special chromosomal staining techniques for chromosome banding.
4	Preparation of karyotypes and idiograms from polar view of mitotic metaphase stage.

(L = Lecture, P = Practical, T = Tutorial)

Mode of Transaction: Lecture Cum Discussion, Seminars, Workshops, Group discussion, Seminars, Self Study and Library Work.

Mode of In-Semester Assessment:

A. Sessional Test: **Marks: 20 + 20**

B. Other Sessional Activities: **Marks: 10**

In- Semester Assessment **Marks: 18**

A. Sessional Activity

a) Discussion
b) Seminars, Workshops
c) Group discussion
d) Self Study and Library Work.

Suggested Readings:

Gardner, R. J. M., Sutherland, G. R., & Shaffer, L. G. (2017). *Chromosome abnormalities and genetic counseling* (5th ed.). Oxford University Press.

Singh, R. J. (2016). *Plant cytogenetics* (3rd ed.). CRC Press.

Klug, W. S., Cummings, M. R., Spencer, C. A., & Palladino, M. A. (2018). *Concepts of genetics* (12th ed.). Pearson.

De Robertis, E. D. P., & De Robertis, E. M. F. (2006). *Cell and molecular biology* (8th ed.). Lippincott Williams & Wilkins.

Karp, G. (2018). *Cell and molecular biology: Concepts and experiments* (8th ed.). Wiley.

Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2014). *Molecular biology of the cell* (6th ed.). Garland Science.

Griffiths, A. J. F., Wessler, S. R., Carroll, S. B., & Doebley, J. (2020). *Introduction to genetic analysis* (12th ed.). W. H. Freeman.

Klug, W. S., Cummings, M. R., Spencer, C. A., & Palladino, M. A. (2019). *Concepts of genetics* (12th ed.). Pearson.

Pierce, B. A. (2020). *Genetics: A conceptual approach* (7th ed.). Macmillan Learning.

1st Semester
M.Sc. BOTANY
SEMESTER-I
Course Code: EC-4-MBOT-101C
Course Title: Plant Ecology-I

Nature of the Course: Elective Course
Component of the course: L-2, T-1, P-1
Total Credit Assigned: = 4

Course	Title	Credit	Marks	ES	IA	L	T	P
EC-101C	Plant Ecology-I	3+1=4	60(T)+20(P)	42	18	45	3	1

Theory

Distribution of credits: **Lecture: 45** **Practical: 00** **Tutorial: 3**
Distribution of Marks: **Full Marks = 60** **End Semester= 42** **In Semester: 18**

Course Contents

Unit	Contents	Marks	L	P	T
1	**Introduction to ecology** Definitions and divisions of plant ecology, basic concepts; Levels of organization hierarchy. Inter-relationships between the living world and the environment, the components and dynamism, homeostasis.	8	9	0	1
2	**Soil** Importance; Origin; Formation; Composition; Physical; Chemical and Biological components; Soil profile; Role of climate in soil development. Soil nutrients and plants; the rhizosphere concept, rhizosphere population, role of soil microorganisms in functioning and restoration of ecosystem, major soil types of India with special reference to the soil of Assam.	9	9	0	1
3	**Biotic interactions** Basic source of energy, autotrophy, heterotrophy; symbiosis, commensalism, parasitism; biomass, standing crop.	8	9	0	
4	**Ecosystems** Structure; Processes; Trophic organisation; Trophic level, Food chains and Food webs; Ecological pyramids, Pyramid of number, biomass and energy.	8	9	0	1
5	**Functional aspects of ecosystem** Principles and models of energy flow; Production and productivity; Ecological efficiencies; Biogeochemical cycles; Cycling of Carbon, Nitrogen, Phosphorus and Sulphur cycle.	9	9	0	
Total		**42**	**45**	**0**	**3**

Practical

Unit	Contents
1	To study the floristic composition of different stands with respect to biotic disturbances as grazed, protected and extensively disturbed areas.
2	To determine the minimum size and number of quadrat necessary for sampling herbaceous vegetation.
3	To study the percentage frequency of species in different stands and comparison with Raunkiaer's Frequency Classes there of.
4	To study the soil profile of a given area.
5	Study of laboratory safety measures.
6	Sterilization of microbiological laboratory instruments.
7	Preparation of culture media.
8	To study the total microbial population in rhizosphere soil

(L = Lecture, P = Practical, T = Tutorial)

Mode of Transaction: Lecture Cum Discussion, Seminars, Workshops, Group discussion, Seminars, Self Study and Library Work.

Mode of In-Semester Assessment:

A. Sessional Test: **Marks: 20 + 20**

B. Other Sessional Activities: **Marks: 10**

In- Semester Assessment **Marks: 18**

A. Sessional Activity

a) Discussion
b) Seminars, Workshops
c) Group discussion
d) Self Study and Library Work.

Suggested Readings:

Odum, E. P., & Barrett, G. W. (2005). *Fundamentals of ecology* (5th ed.). Cengage Learning.

Dash, M. C. (2001). *Fundamentals of ecology*. Tata McGraw-Hill.

Barbour, M. G., Burk, J. H., & Pitts, W. D. (1999). *Terrestrial plant ecology* (3rd ed.). Benjamin Cummings.

Gurevitch, J., Scheiner, S. M., & Fox, G. A. (2006). *The ecology of plants* (2nd ed.). Sinauer Associates.

Larcher, W. (2003). *Physiological plant ecology* (4th ed.). Springer.

Begon, M., Townsend, C. R., & Harper, J. L. (2021). *Ecology: From individuals to ecosystems* (5th ed.). Wiley-Blackwell.

Molles, M. C. (2019). *Ecology: Concepts and applications* (8th ed.). McGraw-Hill Education.

Smith, T. M., & Smith, R. L. (2020). *Elements of ecology* (10th ed.). Pearson.

Sharma, P. D. (2022). *Ecology and environment* (14th ed.). Rastogi Publications.

M.Sc. BOTANY
SEMESTER-I
Course Code: OC-4-MBOT-101
Course Title: Tissue Culture
Nature of the Course: Optional Course
Component of the course: L-2, T-1, P-1
Total Credit Assigned: 4

Distribution of Marks: Full Marks = 80 End Semester= 56 In Semester: 24

Course	Title	Credit	Marks	ES	IA	L	T	P
OC-101	Research Methodology	4	80	56	24	60	4	0

Unit	Content	Marks	L	P	T
1	**Introduction to Plant tissue Culture** Introduction to Plant Tissue culture, Terms and definitions, Historical background, laboratory organization: Design and layout for wash area, media preparation, methods of sterilization, transfer area for aseptic manipulations, Culture rooms, and observation/data collection areas.	13	12	0	1
2	**Tissue Culture Media** Types of Media and its importance; Preparation of stock solutions of macronutrients, micronutrients, PGRs and vitamins, pH and buffers- their significance in media. Plant Growth Regulators: Role of PGRs (auxins, cytokinins, abscissic acid, ethylene and Gibberellins) in plant development.	15	16	0	1
3	**Aseptic Techniques and culture initiation** Methods of sterilization of equipment's, culture media and explants: Washing and preparation of glassware's, packing and sterilization, media sterilization, surface sterilization. Precautions to maintain aseptic conditions, Callus Induction and growth parameters, Callus subculture and maintenance, growth measurements, morphogenesis in callus culture – organogenesis, somatic embryogenesis.	16	20	0	1
4	. **Micropropagation** Micropropagation – stages, advantages, applications, Somatic embryogenesis-induction, factors, comparison with zygotic embryogenesis	12	12	0	1
Total		**56**	**60**	**00**	**04**

Mode of In-Semester Assessment:

A. Sessional Test: Marks: 20 + 20

B. Other Sessional Activities: Marks: 10

In- Semester Assessment Marks: 18

Suggested Readings

1. Robert Smith. Plant tissue culture : Techniques and Experiments. South Asia Edition.
2. Gamborg and Phillip. Plant Cell, Tissue and Organ Culture. Narosa.
3. Dixon and Gonzales. Plant Cell Culture. Panima.
4. Narayanswamy. Plant Cell and Tissue Culture. McGraw Hill.
5. Bhojwani, S.S. and Rajdan, M.K. Plant Tissue Culture : Theory and Practices a revised Edition. Elsevier.
6. Razdan, M.K. Introduction to plant tissue culture. Oxford & IBH Publishers.
7. Chawla, H.S. Introduction to Plant Biotechnology. Oxford & IBH Publishers.
8. Dey, K.K. Plant Tissue Culture.

2nd Semester

M.Sc. BOTANY
SEMESTER-II
Course Code: CC-4-MBOT-201
Course Title: Microbiology
Nature of the Course: Core Course
Component of the course: L-2, T-1, P-1
Total Credit Assigned: 4

Course	Title	Credit	Marks	ES	IA	L	T	P
CC-201	Plant Physiology and Biochemistry	3+1=4	60(T)+20(P)	42	18	45	3	1

Theory

Distribution of credits: **Lecture: 45** **Practical: 00** **Tutorial: 3**
Distribution of Marks: **Full Marks = 60** **End Semester= 42** **In Semester: 18**

Course Contents

Unit	Content	Marks	L	P	T
1	Scope of microbes in industry and environment	3	3	0	1
2	**Bioreactors/Fermenters and fermentation processes** Solid-state and liquid-state (stationary and submerged) fermentations; Batch and continuous fermentations. Components of a typical bioreactor, Types of bioreactors-laboratory, pilotscale and production fermenters; Constantly stirred tank fermenter, tower fermenter, fixed bed and fluidized bed bioreactors and air-lift fermenter	12	14	0	
3	**Microbial production of industrial products** Microorganisms involved, media, fermentation conditions, downstream processing and uses; Filtration, centrifugation, cell disruption, solvent extraction, precipitation and ultrafiltration, lyophilization, spray drying; alcohol (Ethanol) and antibiotic (Penicillin).	11	12	0	1
4	**Microbiology of water.** Water pollution, role of microbes in sewage and domestic waste water treatment systems. Microorganisms as indicators of water quality. Microbial remediation of Arsenic and Fluoride	7	8	0	1
5	**Microbes in agriculture and remediation of contaminated soils.** Biological nitrogen fixation; Mycorrhizae; Bioremediation of contaminated soils. Isolation of root nodulating bacteria,	9	8	0	

	arbuscular mycorrhizal colonization in plant roots. Hydrocarbon removing bacteria.				
Total		42	45	00	03

Practical

Unit	Contents
1	1. Preparation of Culture Media. 2. Demonstration of Microbiological Instrument. 3. Isolation of microbes from root nodules. 4. Practical Record Book. 5. Viva-Voce.

(L = Lecture, P = Practical, T = Tutorial)

Mode of Transaction: Lecture Cum Discussion, Seminars, Workshops, Group discussion, Seminars, Self Study and Library Work.

Mode of In-Semester Assessment:

A. Sessional Test: **Marks: 20+20**

B. Other Sessional Activities: **Marks: 10**

In- Semester Assessment **Marks: 18**

A. Sessional Activity

1. Activities selected from above mentioned list:

a) Lecture cum Discussion
b) Seminars, Workshops
c) Group discussion
d) Self Study and Library Work.

Suggested readings

1. Pelzar, M.J. Jr., Chen E.C. S., Krieg, N.R. (2010). Microbiology: An application based approach. Tata McGraw Hill Education Pvt. Ltd., Delhi.

2. Tortora, G.J., Funke, B.R., Case. C.L. (2007). Microbiology. Pearson Benjamin Cummings, San Francisco, U.S.A. 9th edition.

M.Sc. BOTANY
SEMESTER-II
Course Code: CC-4-MBOT-202
Course Title: Research Methodology
Nature of the Course: Core Course
Component of the course: L-2, T-1, P-1
Total Credit Assigned: 4

Course	Title	Credit	Marks	ES	IA	L	T	P
CC-202	Tools and Techniques in Biological Science	3+1=4	60(T)+20(P)	42	18	3	0	1

Theory

Distribution of credits: **Lecture: 45** **Practical: 00** **Tutorial: 3**
Distribution of Marks: **Full Marks = 60** **End Semester= 42** **In Semester: 18**

Course Contents

Unit	Contents	Marks	L	P	T
1	General principles of research: Meaning, objectives and characteristics of research, criteria of good research, significance of research, research proposal, formulation of hypothesis, research problem, research process, research methods and methodology, Types of research, review of literature, interpretation of results and discussion, data collection, analysis and interpretation, sampling techniques, research report.	12	14	0	1
2	Technical writing: Scientific writing that includes the way of writing Synopsis, research paper, research articles, poster preparation and presentation, and dissertation, Research and Publication ethics, Plagiarism.	10	11	0	1
3	Web-based literature search engines: Introduction to Web Sciences, Google Scholar and PubMed, Impact factor metrics, Reviewing process of Journals.	10	10	0	

4	Bio-Entrepreneurship and overview of Plant based Industries: Importance of entrepreneurship and its relevance in career growth, General introduction to Intellectual Property Rights (IPRs), Patent, Trademarks, Domain names and Geographical indications	10	10	0	1
Total		**42**	**45**	**0**	**3**

(L = Lecture, P = Practical, T = Tutorial)

Mode of Transaction: Lecture Cum Discussion, Seminars, Workshops, Group discussion, Seminars, Self Study and Library Work.

Mode of In-Semester Assessment:

A. Sessional Test: **Marks: 20 + 20**

B. Other Sessional Activities: **Marks: 20**

In- Semester Assessment **Marks: 24**

A. **Sessional Activity**

a) Discussion
b) Seminars, Workshops
c) Group discussion
d) Self Study and Library Work.

Practical

Content
1.Literature survey using online databases and academic search engines. 2.Identification of research gaps from published research articles. 3.Formulation of research objectives and hypotheses. 4.Writing of title, abstract, keywords, and introduction of a research paper. 5.Preparation of citations and references using standard styles (APA/MLA/Vancouver).

(L = Lecture, P = Practical, T = Tutorial)

Mode of Transaction: Lecture Cum Discussion, Seminars, Workshops, Group discussion, Seminars, Self Study and Library Work.

Mode of In-Semester Assessment:

A. Sessional Test: **Marks: 20 + 20**

B. Other Sessional Activities: **Marks: 10**

In- Semester Assessment **Marks: 18**

A.Sessional Activity

1. Activities selected from above mentioned list:

a) Lecture cum Discussion b) Seminars, Workshops c) Group discussion d) Self Study and Library Work.

Suggested Readings:

1. Dawson, C. (2002). Practical research methods. UBS Publishers, New Delhi.

2. Stapleton, P., Yondeowei, A., Mukanyange, J., Houten, H. (1995). Scientific writing for agricultural research scientists – a training reference manual. West Africa Rice Development Association, Hong Kong.

3. Ruzin, S.E. (1999). Plant microtechnique and microscopy. Oxford University Press, New York, U.S.A.

M.Sc. BOTANY
SEMESTER-II
Course Code: CC-4-MBOT-203
Course Title: Biostatistical Tools
Nature of the Course: Core Course
Component of the course: L-2, T-1, P-1
Total Credit Assigned: 4

Course	Title	Credit	Marks	ES	IA	L	T	P
CC-203	Embryology and Anatomy	3+1=4	60(T)+20(P)	42	18	45	3	0

Course Contents

Unit	Content	Marks	L	P	T
1	**Statistical Data** Importance of Biostatistics, Types of Data: attributes and variables, discrete and continuous data, Primary data, Secondary data, Different types of scales- nominal, ordinal, ratio and interval. Presentation of data: Construction of tables with one or more factors of classification. Diagrammatic and graphical representation of grouped data.	10	15	0	1
2	**Frequency distributions** Cumulative frequency distribution and their representation, histogram, frequency polygon and ogives. Measures of central tendency- mean, median, mode, standard deviation, variance.	14	10	0	1
3	**Test of significance** Test of significance, T- test, F- test, Chi square test, ANOVA, Biostatistical tools, Graphics: Bar, Histogram. Pie Chart, and Scatter plot.	10	10	0	
4	**Testing of hypothesis** Hypothesis Testing, Null hypothesis, Sampling distribution for discrete data. Analyses of contingency tables; hypothesis of homogeneity and independence, Correlations and Regression.	8	10	0	1
Total		42	45	00	03

Practical

1. To work out with Biostatistical sums prescribed in theory syllabus.

References

1. Alan Agresti: Categorical Data analysis; John wiley and Sons, New York, USA.

2. Bhatt B R, Srivenkatramana T and Rao Madhva K S (1996): Statistics: A Beginner's Text, Vol 1, and New Age International (P) Ltd.

3. Goon A M, Gupta M K, Das Gupta B. (1991): Fundamentals of Statistics. Vol 1, World Press, Calcutta.

4. Anderson T W and Sclove S L (1978): An Introduction to Statistical Analysis of Data, Houghton Mffin\Co.

5. Snedecor G W and Cochran W G (1967): Statistical Methods. Iowa State University Press. 6. Spiegel, M R (1967): Theory and Problems of Statistics, Schaum's Publishing Series.

2nd Semester
M.Sc. BOTANY
SEMESTER-II
Course Code: EC-4-MBOT- 201A
Course Title: Taxonomy of Angiosperms-II
Nature of the Course: Elective Course
Component of the course: L-2, T-1, P-1
Total Credit Assigned: 4

Course	Title	Credit	Marks	ES	IA	L	T	P
EC-201A	Taxonomy of Angiosperms-II	3+1=4	60(T)+20(P)	42	18	45	3	0

Course Contents

Unit	Contents	Marks	L	P	T
1	**Phytogeography**: Concept, Static and Dynamic Phytogeography, Phytochoria and botanical provinces of India; Major theories, Ranges, Migration and Barriers; Centres of Origin; Vicariance biogeography; Endemism; IUCN categories; Hotspots, India as a megadiversity country; plant introduction and acclimatization.	10	11	0	1
2	**Material basis of Taxonomy**: Concept of Character; Character Correlation, Weighing, Variations; Isolation and Speciation.	6	6	0	
3	Flora of North East India: Characteristics of flora of Northeast India; Endemic, Exotics and RET Plants of North East India, their multiplication and conservation.	7	7	0	1
4	**Phenetic Methods**: Taxometric: Principles, OTUs, coding of characters, Measuring Resemblances, Cluster analysis, Application of Taxometric **Phylogenetic Methods:** Cladistic taxonomy, Character analysis, Cladogram construction and Analysis.	8	9	0	
5	**Families Dicotyledons**: Study of following families with particular reference to systematic position, phylogeny, evolutionary trends and economic importance-Magnoliaceae, Meliaceae, Fabaceae, Brassicaceae, Cucurbitaceae, Apiaceae, Lamiaceae, Verbenaceae, Euphorbiaceae and Asteraceae.	11	12	0	1
Total		**42**	**45**	**0**	**3**

Practical

Unit	Contents
1	1. Drawing, description and identification of plant specimens from selected group of monocot families. 2. Identification of unknown plants with the help of keys from different floras and manuals. 3. Preparation of taxonomic keys at family, genus and species level based on locally available plants.

(L = Lecture, P = Practical, T = Tutorial)

Mode of Transaction: Lecture Cum Discussion, Seminars, Workshops, Group discussion, Seminars, Self Study and Library Work.

Mode of In-Semester Assessment:

A.Sessional Test: **Marks: 20+20**

B.Other Sessional Activities: **Marks: 10**

In- Semester Assessment **Marks: 18**

A. Sessional Activity

1. Activities selected from above mentioned list:

a) Lecture cum Discussion
b) Seminars, Workshops
c) Group discussion
d) Self Study and Library Work.

Suggested Readings:

Singh V., Pande P.C. and Jain D.K. (2017). A textbook of Botany. Angiosperms. Rastogi Publications. Fourth edition. Meerut. New Delhi, 110055.

Sharma O.P. (2021). Plant Taxonomy. Tata McGraw-Hills publishing company limited, 4/12 Asaf Ali Road, New Delhi 110002.

Baruah A. (2000). A textbook of plant systematics. Kalyani publishers New Delhi.

Pullaiah T, S and Karuppusamy. (2018). Regency Publications (Publication)Taxonomy Of Angiosperms 4th Revised Edn (English,Hardback).

Singh, G. (2019). *Plant systematics: An integrated approach* (4th ed.). CRC Pr.

Judd, W. S., Campbell, C. S., Kellogg, E. A., Stevens, P. F., & Donoghue, M. J. (2015). *Plant systematics: A phylogenetic approach* (4th ed.). Sinauer Associates.

Heywood, V. H., Brummitt, R. K., Culham, A., & Seberg, O. (2007). *Flowering plant families of the world.* Royal Botanic Gardens, Kew.

2nd Semester

M.Sc. BOTANY
SEMESTER-II
Course Code: EC-4-MBOT-201B
Course Title: Cytogenetics & Plant Breeding-II
Nature of the Course: Elective Course
Component of the course: L-2, T-1, P-1
Total Credit Assigned: 4

Course	Title	Credit	Marks	ES	IA	L	T	P
EC-201B	Cytogenetics & Plant Breeding-II	3+1=4	60(T)+20(P)	42	18	45	3	0

Course Contents

Unit	Contents	Marks	L	P	T
1	Mutation, spontaneous and induced mutation, molecular basis of gene mutations, action of physical and chemical mutagens, molecular nature and use of transposable elements in prokaryotes and eukaryotes	10	11	0	1
2	Chromosomal aberrations: structural and numerical, aneuploidy, trisomic, tetrasomic, nullisomic and their significance in genetic studies; mutation and ploidy breeding including haploidy in crop improvement.	7	8	0	1
3	Genetic basis of plant breeding: Hybridization, Genetic consequences of hybridization, Emasculation, types, methods of emasculation, heterosis or hybrid vigour	8	9	0	
4	Conventional breeding methods: Breeding procedure for self pollinated, cross pollinated and vegetatively propagated plants, Pedigree, mass selection, IPR related issues, plant variety protection and farmers right.	8	8	0	1
5	Plant genetic engineering: Crop improvement, insect resistance, virus resistance, herbicide resistance, tolerance of environmental extremes in crops - drought, salinity, plant as bioreactors (molecular farming).	9	9	0	
Total		**42**	**45**	**0**	**3**

Practical

Unit	Contents
1	1. Studies of chiasma frequencies in meiosis cell division. 2. Studies of natural and induced chromosomal aberrations. 3. Studies of effects of colchicines on polyploidy. 4. Emasculation and artificial hybridization.

(L = Lecture, P = Practical, T = Tutorial)

Mode of Transaction: Lecture Cum Discussion, Seminars, Workshops, Group discussion, Seminars, Self Study and Library Work.

Mode of In-Semester Assessment:

A.Sessional Test: **Marks: 20+20**

B.Other Sessional Activities: **Marks: 10**

In- Semester Assessment **Marks: 18**

A. Sessional Activity

1. Activities selected from above mentioned list:

a) Lecture cum Discussion
b) Seminars, Workshops
c) Group discussion
d) Self Study and Library Work.

Suggested Readings:

Gardner, R. J. M., Sutherland, G. R., & Shaffer, L. G. (2017). *Chromosome abnormalities and genetic counseling* (5th ed.). Oxford University Press.

Singh, R. J. (2016). *Plant cytogenetics* (3rd ed.). CRC Press.

Klug, W. S., Cummings, M. R., Spencer, C. A., & Palladino, M. A. (2018). *Concepts of genetics* (12th ed.). Pearson.

De Robertis, E. D. P., & De Robertis, E. M. F. (2006). *Cell and molecular biology* (8th ed.). Lippincott Williams & Wilkins.

Karp, G. (2018). *Cell and molecular biology: Concepts and experiments* (8th ed.). Wiley.

Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2014). *Molecular biology of the cell* (6th ed.). Garland Science.

Griffiths, A. J. F., Wessler, S. R., Carroll, S. B., & Doebley, J. (2020). *Introduction to genetic analysis* (12th ed.). W. H. Freeman.

Klug, W. S., Cummings, M. R., Spencer, C. A., & Palladino, M. A. (2019). *Concepts of genetics* (12th ed.). Pearson.

Pierce, B. A. (2020). *Genetics: A conceptual approach* (7th ed.). Macmillan Learning.

2nd Semester

M.Sc. BOTANY
SEMESTER-II
Course Code: EC-4-MBOT- 201C
Course Title: Plant Ecology-II
Nature of the Course: Elective Course
Component of the course: L-2, T-1, P-1
Total Credit Assigned: 4

Course	Title	Credit	Marks	ES	IA	L	T	P
EC-201C	Plant Ecology-II	3+1=4	60(T)+20(P)	42	18	45	3	0

Course Contents

Unit	Contents	Marks	L	P	T
1	Biodiversity, hotspots of diversity, tools used in studying ecosystem diversity and complexity, environmental monitoring; development of plant ecology at national and international level.	7	8	0	1
2	Autecology and population dynamics: ecological clock with detail phonological analysis, population characteristics and dynamics, regulation of population density, r–k selection, species interaction and competition; gene ecology: ecads and ecophenes, ecotypes- characteristics, formation, kinds, delimitation and significance of ecotypes, ecospecies and coenospecies.	10	11	0	
3	Synecology: origin, development and structure of vegetation, methods and purpose of vegetation study; plant community- characteristics, development and classification, analytic and synthetic characters of plant community, life forms and biological spectrum; concept of ecotone, flagship and keystone species.	9	9	0	1
4	Community dynamics (Plant succession): definition, causes, kinds and theories of plant succession, the climax concept, differences of young and mature communities and their ecological efficiency.	8	8	0	1
5	Phytogeography: Principles of phytogeography, static phytogeography and the broad vegetation belts, dynamic phytogeography- basis of dynamic phytogeography, endemism, concept, age and area hypothesis, endemic flora of the world with special reference to India, plant migration and barriers.	8	9	0	
Total		**42**	**45**	**0**	**3**

Practical

Unit	Contents
1	1. To study the Importance Value Index (IVI) of species in different stands. 2. To study the Species Diversity Index (SDI) in a grassland community. 3. To study the Leaf Area Index (LAI) of different species in a community. 4. To study the Stomatal Index (SI) of some species growing in various habitats. 5. To determine the Association Index (AI) of species in different habitats. 6. To determine the Similarity Index (SI) and Dissimilarity Index (DI) of species in different habitats. 7. To study the phenology and reproductive capacity of plants. 8. To study the vegetation of a grassland community by 'Physiognomic method' – the biological spectrum method.

(L = Lecture, P = Practical, T = Tutorial)

Mode of Transaction: Lecture Cum Discussion, Seminars, Workshops, Group discussion, Seminars, Self Study and Library Work.

Mode of In-Semester Assessment:

A.Sessional Test: **Marks: 20+20**

B.Other Sessional Activities: **Marks: 10**

In- Semester Assessment **Marks: 18**

A. Sessional Activity

1. Activities selected from above mentioned list:

a) Lecture cum Discussion
b) Seminars, Workshops
c) Group discussion
d) Self Study and Library Work.

Suggested Readings:

Odum, E. P., & Barrett, G. W. (2005). *Fundamentals of ecology* (5th ed.). Cengage Learning.

Dash, M. C. (2001). *Fundamentals of ecology*. Tata McGraw-Hill.

Barbour, M. G., Burk, J. H., & Pitts, W. D. (1999). *Terrestrial plant ecology* (3rd ed.). Benjamin Cummings.

Gurevitch, J., Scheiner, S. M., & Fox, G. A. (2006). *The ecology of plants* (2nd ed.). Sinauer Associates.

Larcher, W. (2003). *Physiological plant ecology* (4th ed.). Springer.

Begon, M., Townsend, C. R., & Harper, J. L. (2021). *Ecology: From individuals to ecosystems* (5th ed.). Wiley-Blackwell.

Molles, M. C. (2019). *Ecology: Concepts and applications* (8th ed.). McGraw-Hill Education.

Smith, T. M., & Smith, R. L. (2020). *Elements of ecology* (10th ed.). Pearson.

Sharma, P. D. (2022). *Ecology and environment* (14th ed.). Rastogi Publications.

SEMESTER II
Course: IN4-MBOT-201
Course Title: Internship/Apprenticeship/Community Engagement
Credit 4
Total Marks 80

Distribution of credits: **Lecture: 60** **Practical: 00** **Tutorial:**
Distribution of Marks: **Full Marks = 80** **End Semester= 80** **In Semester:**

1. During internships students will see the practical applications of Theoretical Knowledge.
2. Internship programmes will help in the development of technical Skills of the students.
3. Help the students to develop skills in the planning, executing, and managing projects within a specified timeframe and budget.
4. Such activities cultivate the ability to identify issues, analyze data, and implement effective solutions in a professional context.
5. Help in the improvement of written and oral communication skills through report writing, presentations, and collaborative projects.
6. Such activities will help students in achieving proficiency in specific technical skills and laboratory techniques that are critical for professional practice.
7. Community engagement activities will enhance skills in explaining complex scientific concepts to non-specialist audiences, improving public understanding of Botany.
8. Develop a sense of social responsibility by using Botanical knowledge to address community issues and promote public health and safety.
9. Cultivate leadership skills through organizing and leading community projects and activities.
10. Learn to interact respectfully and effectively with individuals from diverse backgrounds, enhancing cultural awareness.

A. Students will go for internship/Apprenticeship in an allied field and will submit a report of the same after the completion of the internship/Apprenticeship.

B. Students may undertake community engagement activities during which they can leverage their specialized knowledge to benefit local communities. Some possible programmes are:

i. **Science Workshops for Schools**: Hands-on experiments, science fairs, Botanical, and career talks.

ii. **Public Health and Safety Campaigns**: Partner with local health organizations to educate the community on issues related to chemical safety, environmental hazards, and health.

iii. **Environmental Conservation Projects:** Water and soil testing for pollutants, community clean-up drives, and developing sustainable waste management practices.

iv. **Mentorship Programs:** Develop mentorship programs where Botany graduates can guide high school or undergraduate students interested in Botany.

v. **Botany in the Community Workshops:** Conduct workshops that demonstrate the role of Botany in everyday life and practical applications.

vi. **Collaborations with Local Businesses:** Conducting audits of Botanical use, suggesting greener alternatives, and implementing recycling programs.

vii. **Chemical Disaster Preparedness:** Work with local emergency services to develop and disseminate chemical disaster preparedness plans.

viii. **Public Lectures and Seminars:** Organize public lectures and seminars on various Botany-related topics.

Preparation and Submission of Report of Internship/Apprenticeship/Community Engagement Activity: **Marks80**

Mark Distribution:

Objective/Importance of the present work	Marks 10
Field/experimental work	Marks30
Discussion of the Present work/Results/Observations	Marks 30
Presentation/Viva	Marks 10

3rd Semester

M.Sc. BOTANY

SEMESTER-III

Course Code: CC-4-MBOT-301

Course Title: Microbiology and Plant Pathology

Nature of the Course: Core Course

Component of the course: L-2, T-1, P-1

Total Credit Assigned: 4

Course	Title	Credit	Marks	ES	IA	L	T	P
CC-301	Microbiology and Plant Pathology	3+1=4	60(T)+20(P)	42	18	45	3	0

Course Contents

Unit	**Contents (Microbiology)**	**Marks**	**L**	**P**	**T**
1	**Microbial diversity:** 'Species' and 'Strain' concept in microbiology, Metagenomics, culturable and unculturable microbes. ICN for virus, bacteria and other microbes, ecological significance of microbes, microbiome concept, microbiology of soil, air, water and milk.	8	9	0	1
2	**Microbial techniques:** sterilization techniques, population estimation (direct spore count, CFU, spectrophotometric method), pure culture and visualization techniques, culture preservation and maintenance	8	9	0	
3	**Microbial genetics & applications:** Genetic recombination, mode of nutrition, growth conditions and nutritional requirements, different metabolic pathways (respiratory and photosynthetic), Application of microbes in the field of agriculture, fermented foods and dairy products.	10	9	0	1
Unit	**Contents (Plant Pathology)**				
4	Principles of plant pathology, mechanism of pathogenesis, symptomatology and epidemiology, host defense mechanism, role of enzymes, toxins in disease management.	8	9	0	1
5	**Plant disease management:** Regulatory, cultural, physical, chemical, biological control of plant diseases; Symptoms, causal organisms, disease cycle & integrated disease management and etiology of certain important plant diseases occurring in NE India such as grey blight of tea, bacterial blight of rice.	8	9	0	
Total		**42**	**45**	**0**	**3**

Practical

Unit	Contents
1	**Microbiology:** 1. Isolation and pure culture of microbes from soil, air and water 2. Identification and characterization of isolated pure cultures 3. Estimation of water quality 4. Identification and characterization of milk bacteria and nodule bacteria 5. Methylene blue reductase test for bacterial contamination of milk 6. Effect of physical and chemical factors on growth of microbes
2	**Plant Pathology:** 1. Study of symptoms of vegetative and reproductive structures of diseases occurring in NE India 2. Measurement of reproductive structures under microscope and Camera Lucida drawing. 3. Preparation of permanent slides for submitting in the examination. 4. Collection and preservation of specimens for submission (herbarium and bottle specimens).

(L = Lecture, P = Practical, T = Tutorial)

Mode of Transaction: Lecture Cum Discussion, Seminars, Workshops, Group discussion, Seminars, Self Study and Library Work.

Mode of In-Semester Assessment:

A.Sessional Test: **Marks: 20+20**

B.Other Sessional Activities: **Marks: 10**

In- Semester Assessment **Marks: 18**

A. Sessional Activity

1. Activities selected from above mentioned list:

a) Lecture cum Discussion
b) Seminars, Workshops
c) Group discussion
d) Self Study and Library Work.

Suggested Readings:

1. Campbell, N.A., Reece J.B., Urry L.A., Cain M.L., Wasserman S.A. Minorsky P.V., Jackson R.B. (2008). Biology, Pearson Benjamin Cummings, USA. 8th edition.

2. Pelczar, M.J. (2001) Microbiology, 5th edition, Tata McGraw-Hill Co, New Delhi.

3. R. C. Dubey & Maheswari, A Text Book of Microbiology.

4. Agrios, G.N. (1997) Plant Pathology, 4th edition, Academic Press, U.K.

5. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley & Sons (Asia) Singapore. 4th edition.

6. Webster, J. and Weber, R. (2007). Introduction to Fungi, Cambridge University Press, Cambridge. 3rd edition.

7. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi and Their Allies, Macmillan Publishers India Ltd.

8. Sharma, P.D. (2011). Plant Pathology, Rastogi Publication, Meerut, India.

9. Awasthi, L. P., & Das, S. (2024). *Plant pathology*. Taylor & Francis.

10. Chahal, S. S., Khetarpal, R. K., & Thind, T. S. (Eds.). (2008). *Plant pathology in India*. Scientific Publishers.

11. Biswas, K. K., Sinha, P., Dua, P., Jambhulkar, P. P., Bashyal, B. M., Behera, S., Hubballi, M., & Viswanathan, R. (Eds.). (2024). *Concepts of plant pathology and disease management*. Indian Phytopathological Society.

12. Indian Phytopathological Society. (2018). *Recent approaches for management of plant diseases*. Indian Phytopathological Society.

13. Tripathi, S. K., & Bhale, M. S. (2020). *Fundamentals of plant pathology*. Scientific Publishers.
Agrios, G. N. (2005). *Plant pathology* (5th ed.). Elsevier Academic Press.

14. Schumann, G. L., & D'Arcy, C. J. (2009). *Essential plant pathology* (2nd ed.). APS Press.

15. Tronsmo, A. M., Munk, L., Jensen, D. F., Klemsdal, S. S., & Tronsmo, A. (2020). *Plant pathology and plant diseases*. CABI.

16. Dickinson, M. (2003). *Molecular plant pathology*. Garland Science.

17. Lucas, J. A. (2020). *Plant pathology and plant pathogens* (4th ed.). Wiley-Blackwell.

3rd Semester

M.Sc. BOTANY

SEMESTER-III

Course Code: CC-4-MBOT-302

Course Title: Molecular Biology

Nature of the Course: Core Course

Component of the course: L-2, T-1, P-1

Total Credit Assigned: 4

Course	Title	Credit	Marks	ES	IA	L	T	P
CC – 302	Molecular Biology	3+1=4	60(T)+20(P)	42	18	45	3	0

Course Contents

Unit	**Contents**	**Marks**	**L**	**P**	**T**
1	Structure, Conformation, Denaturation, Renaturation of Nucleic acids: Nucleosome and Chromatin structure and organization, C-value paradox; transposons and retrotransposons	8	9	0	1
2	DNA replication: Semiconservative, enzymology of DNA replication; Basic concept of end replication problem and DNA synthesis by reverse transcriptase, Circular DNA replication.	8	8	0	
3	Transcription: RNA polymerase in 'prokaryotes' and eukaryotes; RNA transcription; RNA processing & splicing; regulation of gene expression in 'prokaryotes', Operon concept, structure and function of lac operon. RNA interference	10	11	0	1
4	Translation: Genetic code and its features, Ribosome assembly, Charging of tRNA, amino acyl tRNA synthetase, initiation, elongation and termination of protein biosynthesis; Epigenetics, Post translational modifications	8	9	0	1
5	Basic methodologies of manipulating DNA & Genes: Cutting, separating and visualizing DNA pieces, Southern blotting, RFLP, polymerase chain reaction (PCR).	8	8	0	
Total		**42**	**45**	**0**	**3**

Practical

Unit	Contents
1	**Molecular Biology** 1. DNA isolation from plant samples 2. Purification of DNA samples

(L = Lecture, P = Practical, T = Tutorial)

Mode of Transaction: Lecture Cum Discussion, Seminars, Workshops, Group discussion, Seminars, Self Study and Library Work.

Mode of In-Semester Assessment:

A.Sessional Test: **Marks: 20+20**

B.Other Sessional Activities: **Marks: 10**

In- Semester Assessment **Marks: 18**

A. Sessional Activity

1. Activities selected from above mentioned list:

a) Lecture cum Discussion
b) Seminars, Workshops
c) Group discussion
d) Self Study and Library Work.

Suggested Readings:

1. Watson J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M., Losick, R. (2007). Molecular Biology of the Gene, Pearson Benjamin Cummings, CSHL Press, New York, U.S.A. 6th edition.
2. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons Inc., U.S.A. 5th edition.
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. Benjamin Cummings. U.S.A. 9th edition.
4. Russell, P. J. (2010). i-Genetics- A Molecular Approach. Benjamin Cummings, U.S.A. 3rd edition.
5. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition.

3rd Semester

M.Sc. BOTANY

SEMESTER-III

Course Code: CC-4-MBOT-303

Course Title: Evolution, Speciation and Plant Breeding

Nature of the Course: Core Course

Component of the course: L-2, T-1, P-1

Total Credit Assigned: 4

Course	Title	Credit	Marks	ES	IA	L	T	P
CC-401	Evolution, Speciation and Plant Breeding	3+1=4	60(T)+20(P)	42	18	3	0	1

Course Contents

Unit	Contents (Evolution)	Marks	L	P	T
1	Theories of chemial and organic evolution – with special reference to Darwin's theory of natural selection, types of selection, elucidating (a) common ancestry (b) mechanism of variation and natural selection (c) origin of species, types of selection, co-evolution.	8	7	0	1
2	Progressive and Retrogressive evolution. Parallel and Convergent evolution. Isolation and reproductive barriers, Mutation, Genetic drift and Hardy-Weinberg principle and genetic equilibrium. Polyploidy and evolution– Mutation and Evolution, Speciation, types of speciation.	8	6	0	
	Plant Breeding				
3	Methods of plant improvement: Introduction and acclimatization; Pure line and mass selection; hybrid vigour and applications, genetic basis of inbreeding depression	8	10	0	1
4	Genetic basis of plant breeding: Hybridization, Genetic consequences of hybridization, Emasculation, types, methods of emasculation	8	11	0	1
5	Breeding procedure for self pollinated, cross pollinated plants, Pedigree, mass selection, IPR related issues	10	11	0	
Total		**42**	**45**	**0**	**3**

Practical

Unit	Contents (Evolution and Speciation)
1	1. Study of Homologous and analogous organs. 2. Evidences of organic evolution (preparation of photographs, charts etc.). 3. Evolution of organized cells in primitive earth (chart preparation).
	Plant Breeding
2	1. Floral biology study, techniques of emasculation, selfing and hybridization techniques.

(L = Lecture, P = Practical, T = Tutorial)

Mode of Transaction: Lecture Cum Discussion, Seminars, Workshops, Group discussion, Seminars, Self Study and Library Work.

Mode of In-Semester Assessment:

A.Sessional Test: **Marks: 20+20**

B.Other Sessional Activities: **Marks: 10**

In- Semester Assessment **Marks: 18**

A. Sessional Activity

1. Activities selected from above mentioned list:

a) Lecture cum Discussion
b) Seminars, Workshops
c) Group discussion
d) Self Study and Library Work.

Expected Course Learning Outcomes:

After Completion of the course, the students will be able to:

Suggested Readings:

1. Dobzhansky, B (1961) Genetic and origin of species, Columbia university Press New York

2. Verma & Agarwal (2004) Cell Biology, Genetics, Molecular Biology, Evolution & Ecology, S Chand & Co.

3. Higgs, (2005). Bioinformatics and Molecular evolution. Ane Books India Pvt.Ltd.

4. Acquaah, G. (2007). Principles of Plant Genetics &Breeding.NewJearsey, U.S.: Blackwell Publishing.

5. Singh, B.D. (2005). Plant Breeding: Principles and Methods, 7th edition. New Delhi, Delhi: Kalyani Publishers.

6. Chaudhari, H.K. (1984). Elementary Principles of Plant Breeding, 2nd edition. New Delhi, Delhi: Oxford – IBH.

7. Stewart, C.N. Jr. (2008). Plant Biotechnology & Genetics: Principles, Techniques and Applications. John Wiley & Sons Inc. U.S.A.

M.Sc. BOTANY

SEMESTER-III

Course Code: EC-4-MBOT- 301A

Course Title: Taxonomy of Angiosperms-III

Nature of the Course: Elective Course

Component of the course: L-2, T-1, P-1

Total Credit Assigned: 4

Course	Title	Credit	Marks	ES	IA	L	T	P
EC-301A	Taxonomy of Angiosperms-III	3+1=4	60(T)+20(P)	42	18	3	0	1

Course Contents

Unit	**Contents**	**Marks**	**L**	**P**	**T**
1	Sources of Taxonomic Characters: Morphology, Anatomy, Palynology, Embryology, Cytology, Phytochemistry, Serology, major areas.	6	7	0	1
2	Modern Approach to Taxonomy: Molecular Approach in taxonomy, Diagnostic tools, Polymerase Chain Reaction (PCR) analysis, applications of molecular markers in plant taxonomy; Biosystematics: Definition, importance and categories; Role of computers in taxonomic studies, commonly available softwares.	9	10	0	
3	Botanical Survey of India: History, Activities, Publications.	4	4	0	1
4	Taxonomic Literature: Classical and recent literature of World in general and India in particular (World flora, Indian flora); Taxonomic journals, Icones, Check list, Illustrations.	7	7	0	
5	Botanical exploration: Contributions made in earlier and recent periods. Presentation of Data: Flora, Manuals, Monograph, Revision; Preparation of a flora; Botanical keys, their construction and uses.	7	7	0	1
6	Study of following families with particular reference to systematic position, phylogeny, Evolutionary trends and economic importance, Monocot families- Musaceae, Zingiberaceae, Cyperaceae, Poaceae, Orchidaceae.	9	10	0	
Total		**42**	**45**	**0**	**3**

Practical

Unit	Contents
1	1. Identification of unknown plants with the help of keys from local, regional, continental floras and manuals. 2. Preparation of artificial indented/bracketed keys at family, generic and species level, based on locally available plants. 3. Preparation of floral diagrams of some species of selected families: Acanthaceae, Scrophulariaceae, Verbenaceae, Solanaceae, Amaranthaceae, Euphorbiaceae, Bignoniaceae, Pedaliaceae, Moringaceae, Gramineae, Cyperaceae, Violaceae, Polygalaceae, Aizoaceae, Molluginaceae and Rubiaceae. 4. At least two field trips within and around the campus; compilation of field notes and preparation of herbarium sheets of the plants at least 50 abundant wild or cultivated plants.

(L = Lecture, P = Practical, T = Tutorial)

Mode of Transaction: Lecture Cum Discussion, Seminars, Workshops, Group discussion, Seminars, Self Study and Library Work.

Mode of In-Semester Assessment:

A.Sessional Test: **Marks: 20+20**

B.Other Sessional Activities: **Marks: 10**

In- Semester Assessment **Marks: 18**

A. Sessional Activity

1. Activities selected from above mentioned list:

a) Lecture cum Discussion
b) Seminars, Workshops
c) Group discussion
d) Self Study and Library Work.

Suggested Readings:

Singh V., Pande P.C. and Jain D.K. (2017). A textbook of Botany. Angiosperms. Rastogi Publications. Fourth edition. Meerut. New Delhi, 110055.

Sharma O.P. (2021). Plant Taxonomy. Tata McGraw-Hills publishing company limited, 4/12 Asaf Ali Road, New Delhi 110002.

Baruah A. (2000). A textbook of plant systematics. Kalyani publishers New Delhi.

Pullaiah T, S and Karuppusamy. (2018). Regency Publications (Publication)Taxonomy Of Angiosperms 4th Revised Edn (English,Hardback).

Singh, G. (2019). *Plant systematics: An integrated approach* (4th ed.). CRC Pr.

Judd, W. S., Campbell, C. S., Kellogg, E. A., Stevens, P. F., & Donoghue, M. J. (2015). *Plant systematics: A phylogenetic approach* (4th ed.). Sinauer Associates.

Heywood, V. H., Brummitt, R. K., Culham, A., & Seberg, O. (2007). *Flowering plant families of the world.* Royal Botanic Gardens, Kew.

3rd Semester
M.Sc. BOTANY
SEMESTER-III
Course Code: EC-4-MBOT-301B
Course Title: Cytogenetics & Plant Breeding-III
Nature of the Course: Elective Course
Component of the course: L-2, T-1, P-1
Total Credit Assigned: 4

Course	Title	Credit	Marks	ES	IA	L	T	P
EC-301B	Cytogenetics & Plant Breeding-III	3+1=4	60(T)+20(P)	42	18	45	30	0

Course Contents

Unit	Contents	Marks	L	P	T
1	Techniques in molecular genetics; electrophoresis, restriction digestion, ligation, DNA probes and hybridization, DNA cloning, vectors, genomic library and cDNA library, nested PCR, forensics and PCR.	8	9	0	1
2	Basic concepts of molecular genetic markers: *viz.* microsatellite, SNP, RAPD, AFLP, ISSR, monoclonal antibody and hybridoma technology, model organisms in molecular biology.	8	9	0	
3	Concept of epigenetics; chromatin modifications and their mechanism of action, role of chromatin in gene expression and gene silencing, types of histones, histone modifications - methylation, acetylation, phosphorylation, heterochromatin formation and gene silencing.	10	10	0	1
4	Plant cell, tissue and organ cultures; micropropagation and clonal propagation, protoplast culture and somatic hybridization; cytoplasmic hybrids; somaclonal variation, DNA-microchip in plant tissue culture industry.	8	8	0	1
5	rDNA technology: methods and applications; merits, demerits, ethical and environmental concerns on genetic engineering of plants	8	9	0	
Total		**42**	**45**	**0**	**3**

Practical

Unit	Contents
1	1. Media preparation and tissue culture techniques. 2. Demonstration of instruments used in tissue culture.

(L = Lecture, P = Practical, T = Tutorial)

Mode of Transaction: Lecture Cum Discussion, Seminars, Workshops, Group discussion, Seminars, Self Study and Library Work.

Mode of In-Semester Assessment:

A.Sessional Test: **Marks: 20+20**

B.Other Sessional Activities: **Marks: 10**

In- Semester Assessment **Marks: 18**

A. Sessional Activity

1. Activities selected from above mentioned list:

a) Lecture cum Discussion
b) Seminars, Workshops
c) Group discussion
d) Self Study and Library Work.

Suggested Readings:

Gardner, R. J. M., Sutherland, G. R., & Shaffer, L. G. (2017). *Chromosome abnormalities and genetic counseling* (5th ed.). Oxford University Press.

Singh, R. J. (2016). *Plant cytogenetics* (3rd ed.). CRC Press.

Klug, W. S., Cummings, M. R., Spencer, C. A., & Palladino, M. A. (2018). *Concepts of genetics* (12th ed.). Pearson.

De Robertis, E. D. P., & De Robertis, E. M. F. (2006). *Cell and molecular biology* (8th ed.). Lippincott Williams & Wilkins.

Karp, G. (2018). *Cell and molecular biology: Concepts and experiments* (8th ed.). Wiley.

Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2014). *Molecular biology of the cell* (6th ed.). Garland Science.

Griffiths, A. J. F., Wessler, S. R., Carroll, S. B., & Doebley, J. (2020). *Introduction to genetic analysis* (12th ed.). W. H. Freeman.

Klug, W. S., Cummings, M. R., Spencer, C. A., & Palladino, M. A. (2019). *Concepts of genetics* (12th ed.). Pearson.

Pierce, B. A. (2020). *Genetics: A conceptual approach* (7th ed.). Macmillan Learning.

3rd Semester

M.Sc. BOTANY
SEMESTER-III
Course Code: EC-4-MBOT -301C
Course Title: Plant Ecology-III
Nature of the Course: Elective Course
Component of the course: L-2, T-1, P-1
Total Credit Assigned: 4

Course	Title	Credit	Marks	ES	IA	L	T	P
EC-301C	Plant Ecology-III	3+1=4	60(T)+20(P)	42	18	45	3	0

Course Contents

Unit	Contents	Marks	L	P	T
1	Aquatic ecology: fresh water environment, structure, function and physico-chemical nature of major fresh water bodies of N. E. India with special reference to the Kazaringa, Dibru Saikhowa, Manas, Deepor beel and Loktak lake; estuaries and marine habitats.	6	7	0	1
2	Terrestrial ecology: terrestrial environment and its physico – chemical nature in comparison to fresh water habitats; major biomes of the world with special reference to tropical rain forest, tropical deciduous forest, coniferous forest, tropical savanna and grassland, temperate grassland and desert biome.	7	8	0	
3	Plant adaptation: ecological significance of plant adaptation, adaptation induced by soil, water, light, and biotic factors; plant and plant communities as indicators of cropland, mineral resources, and pollution.	6	6	0	1
4	Habitat degradation (land and forest): land use pattern in India, integrated land use planning, soil degradation, forest cover and forest survey of India, deforestation, demand and supply of wood, afforestation- strategy to demand of forest.	7	7	0	
5	Plant ecology and climate change: plants and climate, plant's interaction with environment, vegetation and natural resources, environmental responses of plants, researches on vegetation changes with climate. Global warming, carbon credits, Kyoto protocol, precipitation and sea level rise, The Montreal Protocol, Paris Agreement, UNFCCC, IPCC, Blue carbon initiative, ecological Footprint with emphasis on carbon footprint.	9	10	0	1
6	Deep ecology: definition, principles, deep ecology platform, development, sources of deep ecology, deep ecology movement, misconception in deep ecology, criticism of deep ecology, links with other philosophies.	7	7	0	
Total		**42**	**45**	**0**	**3**

Practical

Unit	Contents
1	1.To study the stratified biomass of different species in different habitats. 2.To study the primary productivity of grassland by harvest method. 3. To study the primary productivity of a fresh water ecosystem by light and dark bottle method. 4.To study the productivity of plants by leaf – disc–method. 5.To study the effect of sampling size on the vegetation analysis. 6.To study the texture, colour, humus and organic matter content in different soil samples. 7.To determine the moisture content, bulk density, porosity, and water holding capacity of different soil samples. 8.Estimation of total nitrogen content in different soil samples. 9.Estimation of phosphorous content in various soil samples. 10. To study the anatomical adaptative characters of hydrophytes, mesophytes and xerophytes.

(L = Lecture, P = Practical, T = Tutorial)

Mode of Transaction: Lecture Cum Discussion, Seminars, Workshops, Group discussion, Seminars, Self Study and Library Work.

Mode of In-Semester Assessment:

A.Sessional Test: **Marks: 20+20**

B.Other Sessional Activities: **Marks: 10**

In- Semester Assessment **Marks: 18**

B. Sessional Activity

1. Activities selected from above mentioned list:

a) Lecture cum Discussion
b) Seminars, Workshops
c) Group discussion
d) Self Study and Library Work.

Suggested Readings:

Odum, E. P., & Barrett, G. W. (2005). *Fundamentals of ecology* (5th ed.). Cengage Learning.

Dash, M. C. (2001). *Fundamentals of ecology*. Tata McGraw-Hill.

Barbour, M. G., Burk, J. H., & Pitts, W. D. (1999). *Terrestrial plant ecology* (3rd ed.). Benjamin Cummings.

Gurevitch, J., Scheiner, S. M., & Fox, G. A. (2006). *The ecology of plants* (2nd ed.). Sinauer Associates.

Larcher, W. (2003). *Physiological plant ecology* (4th ed.). Springer.

Begon, M., Townsend, C. R., & Harper, J. L. (2021). *Ecology: From individuals to ecosystems* (5th ed.). Wiley-Blackwell.

Molles, M. C. (2019). *Ecology: Concepts and applications* (8th ed.). McGraw-Hill Education.

Smith, T. M., & Smith, R. L. (2020). *Elements of ecology* (10th ed.). Pearson.

Sharma, P. D. (2022). *Ecology and environment* (14th ed.). Rastogi Publications.

3rd Semester

M.Sc. BOTANY

SEMESTER-III

Course Code: RP-4-MBOT-301

Course Title: Field Research Project (Community Services)

Nature of the Course: Research Project

Total Credit Assigned: 4

Core Course

Course	Title	Credit	Marks	ES	IA	L	T	P
RP-301	Field Research Project (Community Services)	4	80	80	0	0	0	0

Course Contents

Unit	Contents	Lecturers
1	1. Visit to agricultural research station, tea garden etc. 2. Plantation drive. 3. Community engagement activities will enhance skills in explaining complex scientific concepts to non-specialist audiences, improving public understanding of Botany. 4. Develop a sense of social responsibility by using Botanical knowledge to address community issues and promote public health and safety. 5. Cultivate leadership skills through organizing and leading community projects and activities. 6. Learn to interact respectfully and effectively with individuals from diverse backgrounds, enhancing cultural awareness. A. Students will submit a report of the Field Research Project of same after the completion. B. Students may undertake community engagement activities during which they can leverage their specialized knowledge to benefit local communities. Some possible programmes are: Engagement Activity: **Marks 80** **Mark Distribution:** Objective/Importance of the present work Marks 10 Field/experimental work Marks 30 Discussion of the Present work/Results/Observations Marks 30 Presentation/Viva Marks 10	**Initiation of dissertation work**

4th Semester

M.Sc. BOTANY
SEMESTER-III
Course Code: CC-4-MBOT-401
Course Title: Biotechnology
Nature of the Course: Core Course
Component of the course: L-2, T-1, P-1
Total Credit Assigned: 4

Course	Title	Credit	Marks	ES	IA	L	T	P
CC - 303	Biotechnology	3+1=4	60(T)+20(P)	42	18	45	3	0

Course contents

Unit	Contents	Marks	L	P	T
1	Principles of genetic engineering, restriction endonucleases and its types and biological role, Linear and circular restriction mapping, Cloning Vectors, Prokaryotic (pBR322, Ti plasmid, Bacterial Artificial Chromosome); Lambda phage, Cosmid, Shuttle vector; Eukaryotic Vectors.	8	11	0	1
2	DNA markers and its application in genetic diversity study, genome analysis, genetic mapping, molecular systematics and diagnosis.	8	9	0	1
3	Applications of biotechnology - Genetically modified plants (BT cotton, BT brinjal, golden rice, Flavr Savr Tomato), Superbug, legal and biosafety issues related to GMOs.	8	8	0	
4	Importance of plant tissue culture, requirements, culture medium, culture of plant tissues: root, meristem, anther, pollen and protoplast culture; synthetic seeds, somatic embryogenesis and zygotic embryogenesis; somatic hybridization: protoplast fusion, cybrids, role of tissue culture in crop improvements.	10	11	0	1
5	Features of biological databases, functions and classification, nucleic acid and protein sequence databases, databases based on source and quality of biological data, sequence analysis, multiple sequence alignment, homology and analogy, phylogenetic analysis.	8	6	0	
Total		**42**	**45**	**0**	**3**

Practical

1	**Biotechnology** 1. Gel electrophoresis of isolated DNA sample 2. Preparation of media, demonstration of instruments used in tissue culture. 3. Introduction to NCBI databases 4. Sequence manipulation, multiple sequence alignment, phylogenetic analysis

(L = Lecture, P = Practical, T = Tutorial)

Mode of Transaction: Lecture Cum Discussion, Seminars, Workshops, Group discussion, Seminars, Self Study and Library Work.

Mode of In-Semester Assessment:

A.Sessional Test: **Marks: 20+20**

B.Other Sessional Activities: **Marks: 10**

In- Semester Assessment **Marks: 18**

A. Sessional Activity

1. Activities selected from above mentioned list:

a) Lecture cum Discussion
b) Seminars, Workshops
c) Group discussion
d) Self Study and Library Work.

Suggested Readings:

1. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.

2. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.

3. Bhojwani, S.S. and Bhatnagar, S.P. (2011). The Embryology of Angiosperms. Vikas Publication House Pvt. Ltd., New Delhi. 5th edition.

4. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons, U.K. 5th edition.

5. Stewart, C.N. Jr. (2008). Plant Biotechnology & Genetics: Principles, Techniques and Applications. John Wiley & Sons Inc. U.S.A.

4th Semester

M.Sc. BOTANY
SEMESTER-IV
Course Code: CC-4-MBOT-402
Course Title: Environmental Biology and Biodiversity Conservation
Nature of the Course: Core Course
Component of the course: L-2, T-1, P-1
Total Credit Assigned: 4

Course	Title	Credit	Marks	ES	IA	L	T	P
CC-402	Environmental Biology and Biodiversity Conservation	3+1=4	60(T)+20(P)	42	18	45	3	0

Course Contents

Unit	**Contents**	**Marks**	**L**	**P**	**T**
1	Concept of EIA; types and procedure. Use of GPS, GIS and remote sensing in ecorestoration and environmental management. Concept of *El nino*, *La nina.*	7	8	0	1
2	***Environmental degradation and management***: Deforestation, Coal mining, Crude oil exploration, Industrial contamination, Water quality of river Brahmaputra, Green house effect, Depletion of ozone layer, Acid rain, Solid waste management, Bioremediation of emerging contaminants.	8	9	0	1
3	Environmental problems associated with North East India with special reference to Assam, river dams in North-East India. Geographical peculiarities of Subansiri river and Ranganadi river, Flood and erosion problem of Assam, Scope of climate resilient agriculture in Assam.	6	6	0	
4	Introduction to biodiversity: global perspective, biogeographical regions of India, values of biodiversity. Levels of biodiversity: Community diversity (alpha, beta, and gamma diversity, genetic diversity, pattern diversity), Gradients of biodiversity (altitudinal, insular), Ecosystems diversity. Threats to biodiversity and its conservation, IUCN red list criteria, HIPPO.	8	8	0	1
5	National and International Regulation for Biodiversity conservation, Biodiversity acts, National biodiversity action plan, Corporate Biodiversity Bonds (CBB), IUCN categories, Environmental calendar, Environment related International Protocols, Ecological footprints, carbon credit, Biodiversity register, Hazards policies and agencies of Govt. of India.	8	8	0	
Total		**42**	**45**	**0**	**3**

Practical

Unit	Environmental Biology and Biodiversity Conservation
1	1. To study the floristic composition of different stands with respect to biotic disturbances as grazed, protected and extensively disturbed areas. 2. To determine the minimum size and number of quadrat necessary for sampling herbaceous vegetation. 3. To study the percentage frequency of species in different stands and comparison with Raunkiaer's Frequency Classes thereof. 4. To study the vegetation of a grassland community by 'Physiognomic method' – the biological spectrum method. 5. To study the Importance Value Index (IVI) of species in different stands. 6. To study the primary productivity of a fresh water ecosystem by light and dark bottle method.

(L = Lecture, P = Practical, T = Tutorial)

Mode of Transaction: Lecture Cum Discussion, Seminars, Workshops, Group discussion, Seminars, Self Study and Library Work.

Mode of In-Semester Assessment:

A.Sessional Test: **Marks: 20+20**

B.Other Sessional Activities: **Marks: 10**

In- Semester Assessment **Marks: 18**

A. Sessional Activity

1. Activities selected from above mentioned list:

a) Lecture cum Discussion
b) Seminars, Workshops
c) Group discussion
d) Self Study and Library Work.

Suggested Readings:

1. Odum, E.P. (2005). Fundamentals of ecology. Cengage Learning India Pvt. Ltd., New Delhi. 5th edition.

2. Singh, J.S., Singh, S.P., Gupta, S. (2006). Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi, India.

3. Sharma, P.D. (2010). Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition.

4. Wilkinson, D.M. (2007). Fundamental Processes in Ecology: An Earth Systems Approach. Oxford University Press. U.S.A.

5. Kormondy, E.J. (1996). Concepts of ecology. PHI Learning Pvt. Ltd., Delhi, India. 4th edition.

4th Semester

M.Sc. BOTANY
SEMESTER-IV
Course Code: CC-2-MBOT-403
Course Title: Principles of Ethnobotany

Nature of the Course: Core Course
Component of the course: L-1, T-1, P-0
Total Credit Assigned: 2

Course	Title	Credit	Marks	ES	IA	L	T	P
CC-403	Principles of Ethnobotany	2	40	28	12	30	2	0

Course Contents

Unit	Contents	Marks	L	P	T
1	Ethnobotany & related issues: Scope and functions. History and development of Ethnobotany, Major issues related to ethnobotany (Ethical, Cultural, Social)	10	7	0	1
2	Traditional Scientific knowledge: Indigenous technical knowledge (ITK), Indigenous Agricultural knowledge (IAK), Traditional ecological knowledge (TEK), Rural people's knowledge (RPK), Traditional botanical knowledge (TBK), Integrated knowledge system (IKS).	10	8	0	
3	Methodology and role of ethnobotanical studies: Field work and collection of data, Herbarium preparation and identification of plants, Significance of the following plants in ethnobotanical practices - *Calamus, Citrus, Dioscorea, Kayea, Livistonia, Terminalia, Zingiber, Curcuma,* Temples and sacred places as sources of data and plant conservation	10	8	0	1
4	Legal aspects in Ethnobotany: Concept of RET taxa, Role of IUCN and BSI in conservation, Biopiracy, CITES, Intellectual Property Rights with reference to Traditional Knowledge.	10	7	0	
Total		**28**	**30**	**0**	**2**

(L = Lecture, P = Practical, T = Tutorial)

Mode of Transaction: Lecture Cum Discussion, Seminars, Workshops, Group discussion, Seminars, Self Study and Library Work.

Mode of In-Semester Assessment:

A.Sessional Test: **Marks: 20+20**

B.Other Sessional Activities: **Marks: 10**

In- Semester Assessment **Marks: 12**

B. Sessional Activity

1. Activities selected from above mentioned list:

a) Lecture cum Discussion
b) Seminars, Workshops
c) Group discussion
d) Self Study and Library Work.

Suggested Readings:

1. Trivedi P C, 2006. Medicinal Plants: Ethnobotanical Approach, Agrobios, India.
2. Purohit and Vyas, 2008. Medicinal Plant Cultivation: A Scientific Approach, 2ndedn. Agrobios, India.

4th Semester

M.Sc. BOTANY
SEMESTER-IV
Course Code: EC-4-MBOT-401A
Course Title: Taxonomy of Angiosperms-IV

Nature of the Course: Elective Course
Component of the course: L-2, T-1, P-1
Total Credit Assigned: 4

Course	Title	Credit	Marks	ES	IA	L	T	P
EC-401A	Taxonomy of Angiosperms-IV	3+1=4	60(T)+20(P)	42	18	45	3	0

Course Contents

Unit	Contents	Marks	L	P	T
1	Comparative Morphology of vegetative / Floral Parts of Selected Angiospermic Families ● Stems of Apocynaceae, Lamiaceae, Euphorbiaceae, Orchidaceae, Musaceae, Zingiberaceae, Liliaceae, Cyperaceae & Poaceae. ● Leaves of Ranunculaceae, Magnoliaceae, Fabaceae, Orchidaceae, Musaceae, Liliaceae & Poaceae. ● Inflorescences of Magnoliaceae, Asteraceae, Lamiaceae, Euphorbiaceae, Musaceae, Liliaceae & Poaceae. ● Flowers of Magnoliaceae, Asteraceae, Orchidaceae & Poaceae. ● Perianth of Magnoliaceae, Euphorbiaceae, Orchidaceae, Musaceae, Liliaceae & Poaceae. ● Androecium / Stamens of Magnoliaceae, Fabaceae, Asteraceae, Apocynaceae, Solanaceae, Acanthaceae, Lamiaceae, Orchidaceae, Musaceae, ● Gynoecium / Carpels of Magnoliaceae, Fabaceae, Asteraceae, Euphorbiaceae, Solanaceae, Lamiaceae, Orchidaceae, ● Fruits/ Seeds of Ranunculaceae, Magnoliaceae, Fabaceae, Asteraceae, Solanaceae, Orchidaceae	16	17	0	1
2	Range / Diversity of Floral Structures in some Angiospermic Families Range of floral structures in Ranunculaceae. ● Range of floral structures in Magnoliaceae. ● Range of floral structures in Fabaceae. ● Range of floral structures in Asteraceae. ● Range of floral structures in Lamiaceae. ● Range of floral structures in Orchidaceae. ● Range of floral structures in Poaceae.	10	11	0	1
3	Comparison of Some Selected Angiospermic Families ● Sub- families of the family Fabaceae. ● Magnoliaceae and Asteraceae. ● Orchidaceae and Poaceae. ● Musaceae and Zingiberaceae.	8	9	0	1

4	Critical / Literature Review on some Selected Angiospermic families Critical review/ discussion on primitiveness of the order Magnoliales - Ranales ● Critical review/ discussion on advancement (systematic position) of the family Asteraceae. ● Critical review/ discussion on advancement (Phylogeny and Affinities) of the taxon Orchidales & Poales.	8	8	0	
Total		**42**	**45**	**0**	**3**

Practical

Unit	Contents
1	1. Solving of nomenclatural problems based on the rules of ICN 2. Preparation of check list of the species of a genus following the Website of www.**ipni**.org/**ipni**/query_**ipni**.html;www.**ipni**.org;http://www.britannica.com/EBchecked/ topic/285218/Index-Kewensis; and the recently published local floras and periodicals. 3. Familiarity with taxonomic literatures: Dictionaries, Glossaries, Manuals, Floras, Bibliographies. 4. Study of morphology of pollen grains.

(L = Lecture, P = Practical, T = Tutorial)

Mode of Transaction: Lecture Cum Discussion, Seminars, Workshops, Group discussion, Seminars, Self Study and Library Work.

Mode of In-Semester Assessment:

A.Sessional Test: Marks: 20+20

B.Other Sessional Activities: Marks: 10

In- Semester Assessment Marks: 18

A. Sessional Activity

1. Activities selected from above mentioned list:

a) Lecture cum Discussion
b) Seminars, Workshops
c) Group discussion
d) Self Study and Library Work.

Suggested Readings:

Singh V., Pande P.C. and Jain D.K. (2017). A textbook of Botany. Angiosperms. Rastogi Publications. Fourth edition. Meerut. New Delhi, 110055.

Sharma O.P. (2021). Plant Taxonomy. Tata McGraw-Hills publishing company limited, 4/12 Asaf Ali Road, New Delhi 110002.

Baruah A. (2000). A textbook of plant systematics. Kalyani publishers New Delhi.

Pullaiah T, S and Karuppusamy. (2018). Regency Publications (Publication)Taxonomy Of Angiosperms 4th Revised Edn (English,Hardback).

Singh, G. (2019). *Plant systematics: An integrated approach* (4th ed.). CRC Pr.

Judd, W. S., Campbell, C. S., Kellogg, E. A., Stevens, P. F., & Donoghue, M. J. (2015). *Plant systematics: A phylogenetic approach* (4th ed.). Sinauer Associates.

Heywood, V. H., Brummitt, R. K., Culham, A., & Seberg, O. (2007). *Flowering plant families of the world.* Royal Botanic Gardens, Kew.

4th Semester
M.Sc. BOTANY
SEMESTER-IV
Course Code: EC-4-MBOT-401B
Course Title: Cytogenetics & Plant Breeding-IV

Nature of the Course: Elective Course
Component of the course: L-2, T-1, P-1
Total Credit Assigned: 4

Course	Title	Credit	Marks	ES	IA	L	T	P
EC-401B	Cytogenetics & Plant Breeding-IV	3+1=4	60(T)+20(P)	42	18	45	3	0

Course Contents

Unit	Contents	Marks	L	P	T
1	Genome organization in viruses, prokaryotes and eukaryotes; organization of nuclear and organellar genomes; satellite DNAs and interspersed repeated DNAs; split genes, pseudogenes, overlapping genes and multigene families.	10	11	0	1
2	Structure and processing of messenger RNA, transfer RNA, ribosomal RNA, small interfering RNAs and micro RNAs, regulation through RNA processing and decay, alternative splicing	8	9	0	1
3	Enzymes in Genetic Engineering: Restriction endonuclease type I and II, Polynucleotide kinase, T4 DNA ligase, Nick translation system, Reverse transcriptase	8	9	0	
4	Cloning in Recombinant DNA technology: Cloning vectors-Plasmid, Cosmid, Yeast Cloning Vector, Ti plasmid; Transformation (Bacteria and Plant), Selection and Screening of recombinants.	8	8	0	1
5	Genetically engineered foods; molecular farming and plantibodies, antisense RNA technology; biosafety issues related to genetically modified organisms.	8	8	0	
Total		**42**	**45**	**0**	**3**

Practical

Unit	Contents
1	1. Isolation of genomic DNA from plant materials, purification, estimation 2. Separation with gel electrophoresis and documentations. 3. Working out of genetical problems.

(L = Lecture, P = Practical, T = Tutorial)

Mode of Transaction: Lecture Cum Discussion, Seminars, Workshops, Group discussion, Seminars, Self Study and Library Work.

Mode of In-Semester Assessment:

A.Sessional Test: **Marks: 20+20**

B.Other Sessional Activities: **Marks: 10**

In- Semester Assessment **Marks: 18**

A. Sessional Activity

1. Activities selected from above mentioned list:

a) Lecture cum Discussion
b) Seminars, Workshops
c) Group discussion
d) Self Study and Library Work.

Suggested Readings:

Gardner, R. J. M., Sutherland, G. R., & Shaffer, L. G. (2017). *Chromosome abnormalities and genetic counseling* (5th ed.). Oxford University Press.

Singh, R. J. (2016). *Plant cytogenetics* (3rd ed.). CRC Press.

Klug, W. S., Cummings, M. R., Spencer, C. A., & Palladino, M. A. (2018). *Concepts of genetics* (12th ed.). Pearson.

De Robertis, E. D. P., & De Robertis, E. M. F. (2006). *Cell and molecular biology* (8th ed.). Lippincott Williams & Wilkins.

Karp, G. (2018). *Cell and molecular biology: Concepts and experiments* (8th ed.). Wiley.

Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2014). *Molecular biology of the cell* (6th ed.). Garland Science.

Griffiths, A. J. F., Wessler, S. R., Carroll, S. B., & Doebley, J. (2020). *Introduction to genetic analysis* (12th ed.). W. H. Freeman.

Klug, W. S., Cummings, M. R., Spencer, C. A., & Palladino, M. A. (2019). *Concepts of genetics* (12th ed.). Pearson.

Pierce, B. A. (2020). *Genetics: A conceptual approach* (7th ed.). Macmillan Learning.

4th Semester
M.Sc. BOTANY
SEMESTER-IV
Course Code: EC-4-MBOT-401C
Course Title: Plant Ecology-IV

Nature of the Course: Elective Course
Component of the course: L-2, T-1, P-1
Total Credit Assigned: 4

Course	Title	Credit	Marks	ES	IA	L	T	P
EC-401C	Plant Ecology-IV	3+1=4	60(T)+20(P)	42	18	45	3	0

Course Contents

Unit	Contents	Marks	L	P	T
1	Environmental pollution and plant ecology: vegetation responses to environmental pollution, deforestation and environmental pollution, air and water pollution and the productivity of economic crops of N.E. India; Bioremediation and phytoremediation of environmental pollution	8	9	0	1
2	Environment Impact Assessment (EIA): Methods of EIA evaluation with special reference to adhock method and check list method, role of various agencies in operation of an EIA programme.	6	6	0	
3	Weed ecology: definition, classification, origin and evolution, ecological significance, weeds in natural and agro ecosystems, weeds as human hazards, weeds associated with major crops of India, chemical and biological control of weed.	5	5	0	1
4	Conservation and management: state of affairs of the prevailing environmental stress upon various productive ecosystems, range management, forest management, soil conservation, conservation of endangered genetic resources.	6	7	0	
5	Agroecosystem management and sustainable agriculture: system approach in agriculture, mutually antagonistic nature of ecology and efficient agriculture; sustainable agriculture: complex agroecosystems- shifting agriculture, rotational fallow, home gardens, mixed arable live-stock farming, agri-silviculture, specialized cash crop systems, intercropping and crop rotation, integrated landscape management for cropping with 'Global Change', agriculture and globalization.	10	11	0	1

6	Chemical ecology: Secondary metabolites, allelopathy and Kairopathy, biomagnifications and bioaccumulation of hazardous chemicals in food chains; Structural and functional aspects of certain bioactive compounds (curcumin, andrographoloids, azadirachtin, reserpine, vasicine etc.) , their antioxidant and antimicrobial activity.	7	7	0	
Total		**42**	**45**	**0**	**3**

Practical

Unit	Contents
1	1. Study of bioremediation/phytoremediation. 2. Determination of total solids (TS), Total Dissolved Solids (TDS), and Total Suspended Solids (TSS) of water by heat and weight method. 3. To study the allelopathic / kairopathic action of plants on associated plants. 4. Phytochemical extraction of certain MAPs and their antimicrobial and antioxidant activity study. 5. To study the PH, turbidity, temperature and light intensity in a fresh water system.

(L = Lecture, P = Practical, T = Tutorial)

Mode of Transaction: Lecture Cum Discussion, Seminars, Workshops, Group discussion, Seminars, Self Study and Library Work.

Mode of In-Semester Assessment:

A.Sessional Test: **Marks: 20+20**

B.Other Sessional Activities: **Marks: 10**

In- Semester Assessment **Marks: 18**

A. Sessional Activity

1. Activities selected from above mentioned list:

a) Lecture cum Discussion
b) Seminars, Workshops
c) Group discussion
d) Self Study and Library Work.

Suggested Readings:

Odum, E. P., & Barrett, G. W. (2005). *Fundamentals of ecology* (5th ed.). Cengage Learning.

Dash, M. C. (2001). *Fundamentals of ecology*. Tata McGraw-Hill.

Barbour, M. G., Burk, J. H., & Pitts, W. D. (1999). *Terrestrial plant ecology* (3rd ed.). Benjamin Cummings.

Gurevitch, J., Scheiner, S. M., & Fox, G. A. (2006). *The ecology of plants* (2nd ed.). Sinauer Associates.

Larcher, W. (2003). *Physiological plant ecology* (4th ed.). Springer.

Begon, M., Townsend, C. R., & Harper, J. L. (2021). *Ecology: From individuals to ecosystems* (5th ed.). Wiley-Blackwell.

Molles, M. C. (2019). *Ecology: Concepts and applications* (8th ed.). McGraw-Hill Education.

Smith, T. M., & Smith, R. L. (2020). *Elements of ecology* (10th ed.). Pearson.

Sharma, P. D. (2022). *Ecology and environment* (14th ed.). Rastogi Publications.

SEMESTER IV
Course: RESEARCH PROJECT OR CORE COURSE
Credit 6, Total Hours =120
Total Marks 120
M.Sc. BOTANY
Course Code: DIS-6-MBOT-401
Nature of the Course: Research Project
Total Credit Assigned: 6

Course	Title	Credit	Marks	ES	IA	L	T	P
RP-401	Taxonomy of Angiosperms-IV or Cytogenetics & Plant Breeding -IV or Plant Ecology-IV	6	120	120	0	0	0	0

[Mark Distribution for evaluation of the Project Work
Laboratory Experiment

1. Literature Review	10 Marks
2. Objectives	10 Marks
3. Experimental work	25 Marks
4. Results & Discussions	25 Marks
5. Presentation and Viva	20 Marks
6. IA	30 Marks

Note: Students are encouraged to carry out laboratory experiments individually (However incase of infrastructural issues a maximum of 4 students can perform experiments together). The format of the report to be submitted is attached as **Annexure 1** below:

Annexure 1:
Guidelines for preparation of Dissertation/Project Report

1. Organization of the Dissertation/Project Report:

The Dissertation/Project Report shall be presented in a number of chapters, starting with 'Introduction' and ending with 'Conclusion'. The chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections and sub-sections to present the content discretely. Total numbers of chapters may be ranged from1- 5(minimum) and 1-8(maximum).

1.1 Introduction:

The title of Chapter-I shall be 'Introduction'. It shall justify the research problem, define the topic and explain the aim and scope of the proposed research. The significant contribution from the investigation to civil society may also be focused in this chapter.

1.2 Review of Literature:

The title of Chapter-II shall be "Review of Literature". This chapter shall present a critical appraisal of the previous works published in the literature pertaining to the topic of the investigation.

1.3 Report on the Present Investigation:

The reporting on the investigation shall be presented in one or more chapters with appropriate title.

- Due importance shall be given to procedures and methodologies adopted.
- Figures and tables should be presented immediately following their first mention in the text. Short tables and figures (say, less than half the writing are of the page) should be presented within the text, while large tables and figures may be presented on separate pages.

1.4 Results and Discussions:

This is the penultimate chapter of the report and shall include a thorough evaluation of the research problem carried out and bring out the contributions from the study. The discussion shall logically lead to meaningful conclusions.

1.5 Conclusions:

This is the last chapter of the report. A brief report of the work carried out shall form the first part of the chapter. Conclusions derived from the logical analysis presented in the "Results and Discussions" chapter shall be presented and clearly enumerated. This chapter should indicate the possibilities/ scope for future work in the concerned field.

NB: In non-empirical research, particularly in the discipline of Humanities and Social Sciences, textual/content analysis may be conceived in several chapters with appropriate title instead of present investigation, results and discussion.

1.6 Appendix:

Detailed information, lengthy derivations, observations etc. are to be presented in the separate appendices, which shall be numbered in Roman Capitals (e.g. "Appendix-I")

1.7 Bibliography:

This should follow the appendices, (if any), otherwise the Conclusion chapter. The researchers shall follow either the MLA (latest edition), or APA (latest edition) referencing style, or any other style whichever is accepted by the concerned department.

2. Dissertations/Project Reports Format:

2.1 Paper:

The report shall be in printed form and the size of the paper shall be standard A4; height 297mm, width 210mm.

2.2 Type–Setting, Text Processing and Printing:

The text shall be printed on single side of a page employing laserjet or inkjet printer. The text having been processed using a standard text processor. The standard font should be **Time New Roman** of **12**pts with **1.5** line spacing for **English** text while **Geetanjali** of **12**pts with**1.5**l ine spacing and **Mangal** / **Unicode**of12ptswith1.5spacingfor**Assamese**and**Hindi**textsrespectively**.**

2.2.1 Page Format:

The Printed sheets shall have the following written area and margins: Top margin: 15mm

Head height	:3mm
Head separation	:12mm
Bottom margin	:22mm
Footer	:3mm
Foot separation	:10mm
Left margin	:30mm
Right margin	:20mm
Text height	:245mm
Text width	:160mm

When header is not used, the top margin shall be 30mm.

2.2.2 Pagination:

Page numbering in the text of the Dissertation/Report shall be Hindu- Arabic numerals at the right corner of the Page. Page number "1" for the first page of the Introduction chapter should not appear in print; only the second page will bear the number "2". The subsequent chapters shall begin on a fresh page. Pagination for pages before the Introduction chapter shall be in lower case Roman numerals, e.g., "i", " ii" etc.

2.2.3 Header:

When the header style is chosen, the header can have the Chapter number and Section number (e.g., Chapter-II, Section-iii) on even numbered page headers and Chapter title or Section title on the numbered page header.

2.2.4 Paragraph format:

Vertical space between paragraphs shall be about 2.5 line spacing. A paragraph should normally comprise more than one line. A single

line of a paragraph shall not be left at the top or bottom of a page.

2.3 Chapter and Section Format:

2.3.1 Chapter:

Each chapter shall begin on a fresh page with an additional top marginof about 75mm. Chapter number (Roman Numerical) and title shall be printed at the centre of the line in 6mm font size (18pt) in bold face using both upper and lower case. (See the specimen: 'E')

2.3.2 Section and Sub-sections:

A chapter can be divided into Section and Sub-Sections so as to present different concepts separately. Sections and sub-sections can be number redusing decimal points, e.g. II.iifor these condsection in Chapter-IIand II.iii.4 for the fourth Sub-section in third section of Chapter-II.

2.3.3 Table/Figure Format:

Tables and figures should be presented in portrait style. Small size table and figures (less than half of writing area of a page) should be incorporated within the text, while larger ones may be presented on separate pages. Tables and figures shall be numbered chapter-wise. For example, the second figure in Chapter-IV will bear the number Figure IV.2 or Fig. IV.2.

3.0 Auxiliary Format:

3.1 Binding:

The final hard bound copies to be submitted after the viva-voce examination will be accepted during the submission of Dissertation/ Project Report with**black colour** for **P.G**and **brown colour** for **U.G** course respectively.

3.2 Front Covers:

The front covers shall contain the following details:

- Full title of Dissertation/ Project Report in 6mm 22point's size font properly centered and positioned at the top.
- Full name of the candidate in 4.5mm 15 point's size font properly centered at the middle of the page.
- A50mmdiereplicaoftheinstituteemblem followed by the name of the supervisor, name of the department, name of the institute and the year of submission, each in a separate line and properly centered and located at the bottom of page.

3.2.1 Lettering:

All lettering shall be embossed in gold.

3.2.2 Bound back:

The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

3.3 Blank Sheets:

In addition to the white sheets (binding requirement) two white sheets shall be put at the beginning and the end of the Dissertation/Project Report.

3.4 Title Sheet:

This shall be the first printed page of the report and shall contain the submission statement: the Dissertation/ Project Report submitted in partial fulfillment of requirements of the------Degree, thenameand Roll No. of the candidate, name(s) of the Supervisor and Co- supervisor(s) (if any), Department, Institute and year of submission.

- Sample copy of the‘Title Sheet’ is appended (Specimen‘A’)

3.5 Approval Sheet:

This will form the first page of the Dissertation/Project Report. Sample copy of the ‘Internal Approval Sheet’ is appended (Specimen ‘B’)

3.6 Internal Approval Sheet:

This will form the secondpage. A sample copy of the Approval Sheet is appended (Specimen ‘C’)

3.7 A Declaration of Academic Honesty and Integrity:

A declaration of academic honesty and integrity is required to be included along with every Dissertation/Project Report after the internal approval sheet. The format of this declaration is given in Specimen ‘D’ attached.

3.8 Acknowledgements:

A list of acknowledgements is required to be included along with every Dissertation/ Project Report after the Declaration sheet.

3.9 Contents:

NB: From 3.5 to 3.8, the pagination should be in Roman number with lower case.

Specimen 'A': Title Sheet

Title

(A Dissertation/Project Report submitted in partial fulfillment of the requirements of BA/BSc/MA/MSc degree in (subject))

by

(Name of the Student)
(Roll No. _____)
Registration No. ……

Supervisor(s):
(Name of Supervisor)
(Name of the Department)
North Lakhimpur College (Autonomous) (Year)

Specimen 'B': Approval Sheet

Dissertation Approval for……

This Dissertation/Project Report entitled (**Title**) by (**Author Name**) is approved for the degree of **_____**(**Degree details**).

Examiners

1. ……
2. ……

Date:

Specimen 'C': Internal Approval Sheet

CERTIFICATE

This is to certify that the Dissertation/Project Report entitled "**Title of Dissertation/Project**" is a bona-fide work of "**Name of student" (Roll No**…., **Regd. No……..**) submitted to the North Lakhimpur College (Autonomous) in partial fulfillment of the requirements for the award of "B.A./B. Sc./M.A/M. Sc. degree in (subject)"

(Name and Sign)
Supervisor

(Name and Sign)
Co-Supervisor

(Name and Sign)
Head of
Department

Specimen 'D': Declaration

DECLARATION

I, (name), do hereby declare that the dissertation/Project Report entitled "Title" represents my idea in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misinterpreted or fabricated or falsified any idea/ data/ fact/ source in my submission. I understand that any violation of the above will invite disciplinary action by the institute.

…….

(Signature)

……

… (Name of student and Roll No)

Date:

Place:

Specimen 'E': Starting Chapter page Formatting.

Chapter – I
Introduction

1.1 (Specimen 'E')

1.2 Formatting Guidelines

Works cited

…….

Chapter–II

Title

2.1 ……..

2.2 ……..

Workscited

……..

Specimen ‘F’: Standards Style references

References

MLA 9th Edition

Refer to Appendix- I (for quick guide)

APA 7th Edition

Refer to Appendix-II (for quick guide)