

**DEPARTMENT OF BOTANY
NORTH LAKHIMPUR COLLEGE
(AUTONOMOUS)
Lakhimpur, Assam**



**M.Sc. Botany
Choice Based Credit System
Syllabus**

Effective from Academic Session 2021-2022

Passed in Board of Studies on 18/09/2021 (1st & 2nd Sem) and 16/07/2022 (3rd & 4th Sem), revised on 29/04/2023

Outline of the M.Sc. Syllabus in Botany (CBCS mode)

Course Categories: CC: Core Course, DS: Discipline Specific Elective Course, GE: Generic Elective Course, AE: Ability Enhancement Course.

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

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

1st Semester:

Course	Title	Credit	Marks	ES	IA	L	T	P
CC-101	Phycology, Mycology & Plant Pathology	3	100	70	30	3	1	0
CC-102	Cell Biology & Molecular Biology	3	100	70	30	3	1	0
CC-103	Environmental Biology	3	100	70	30	3	1	0
CC-104	Lab Course on CC (101-103)	3	100	100	0	0	0	6
AE-101	Principles of Ethnobotany	2	50	35	15	2	1	0
DS-101A	Taxonomy of Angiosperms - I	4	100	70	30	3	2	0
DS-102A	Lab Course on DS-101A	2	50	50	0	0	0	4
DS-101B	Cytogenetics & Plant Breeding - I	4	100	70	30	3	2	0
DS-102B	Lab Course on DS-101B	2	50	50	0	0	0	4
DS-101C	Plant Ecology - I	4	100	70	30	3	2	0
DS-102C	Lab Course on DS-101C	2	50	50	0	0	0	4
		20						

2nd Semester:

Course	Title	Credit	Marks	ES	IA	L	T	P
CC-201	Bryophytes, Pteridophytes and Gymnosperms	3	100	70	30	3	1	0
CC-202	Morphology & Taxonomy of Angiosperms	3	100	70	30	3	1	0
CC-203	Lab Course on CC (201 & 202)	4	100	100	0	0	0	6
GE-201	Research Methodology	4	100	70	30	3	1	0
DS-201A	Taxonomy of Angiosperms - II	4	100	70	30	3	2	0
DS-202A	Lab Course on DS-201A	2	50	50	0	0	0	4
DS-201B	Cytogenetics & Plant Breeding - II	4	100	70	30	3	2	0
DS-202B	Lab Course on DS-201B	2	50	50	0	0	0	4
DS-201C	Plant Ecology - II	4	100	70	30	3	2	0
DS-202C	Lab Course on DS-201C	2	50	50	0	0	0	4
		20						

3rd Semester:

Course	Title	Credit	Marks	ES	IA	L	T	P
CC-301	Cytogenetics & Plant Breeding	3	100	70	30	3	1	0
CC-302	Microbiology	2	50	35	15	2	1	0
CC-303	Lab work based on CC (301 & 302)	3	100	100	0	0	0	6
AE-301	Tools and Techniques in Biology	2	50	35	15	2	1	0
GE-301	Plant Tissue Culture	4	100	60	20	3	2	1
DS-301A	Taxonomy of Angiosperms - III	4	100	70	30	3	2	0
DS-302A	Lab Course on DS-301A	2	50	50	0	0	0	4
DS-301B	Cytogenetics & Plant Breeding - III	4	100	70	30	3	2	0
DS-302B	Lab Course on DS-301B	2	50	50	0	0	0	4
DS-301C	Plant Ecology – III	4	100	70	30	3	2	0
DS-302C	Lab Course on DS-301C	2	50	50	0	0	0	4
		20						

4th Semester:

Course	Title	Credit	Marks	ES	IA	L	T	P
CC-401	Embryology & Anatomy	4	100	70	30	4	2	0
CC-402	Lab Course based on CC- 401	3	100	100	0	0	0	6
CC-403	Plant Physiology & Biochemistry	4	100	70	30	3	2	0
CC-404	Lab Course based on CC- 403	3	100	100	0	0	0	6
DS-401A	Project Work: Taxonomy of Angiosperms - IV	6	120	120	0	0	0	0
DS-401B	Project Work: Cytogenetics & Plant Breeding – IV	6	120	120	0	0	0	0
DS-401C	Project Work: Plant Ecology - IV	6	120	120	0	0	0	0
		20						

- i) Only one Discipline Specific Elective Course (DS) should be selected in the 1st Semester and will be continued to 3rd Semester.
- ii) For Project work, option selected in 1st Semester will be continued in 4th Semester.
- iii) Field study can be made in any semester as per convenience.

1st Semester

M.Sc. BOTANY
SEMESTER-I
Core Course MBT-CC-T3-101
Phycology, Mycology & Plant Pathology

Course	Title	Credit	Marks	ES	IA	L	T	P
CC-101	Phycology, Mycology & Plant Pathology	3	100	70	30	3	1	0

PHYCOLOGY: (Marks : 23)

Unit 1: Diversity of habitat, cell structure, thallus organization among algae Classification of algae with special reference to Fritsch's classification, Algal food reserve types, Economic importance of algae: Food, feed, industry, biofertilizers, medicine and algal bloom. (Marks 9)

Unit 2: Reproduction and representative types of life-cycles of algae. (Marks 7)

Unit 3: General account on: Myxophyceae, Symbiotic association of algae with special reference to lichen, mechanism of phycobiont and mycobiont interaction, Economic importance of Lichen. (Marks 7)

MYCOLOGY: (Marks : 24)

Unit 1: Fungi: Cell structure, flagella, cell wall composition, diversity in thallus structure, reproduction, parasexuality, classification; economic importance of fungi: medicine, industry, food, mycorrhiza (Marks 12)

Unit 2: Systematic study of the structure, reproduction and classification of each group: *Oomycetes, Zygomycetes, Ascomycetes, Basidiomycetes, Deuteromycetes.* (Marks 12)

PLANT PATHOLOGY: (Marks : 23)

Unit 1: Principles of plant pathology, mechanism of pathogenesis, symptomatology and epidemiology, host defense mechanism, role of enzymes, toxins in disease management. (Marks 10)

Unit 2: 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 stem gall of coriander, grey blight of tea, Leaf curl of Chilly, bacterial blight of rice. (Marks 13)

References:

1. Alexopoulos C. J. and Mims C. W. 1979. Introductory Mycology. John Wiley and Sons. New York.
2. Bessey - Morphology and taxonomy of fungi, Hafner. Pub. Company.
3. Bower - Primitive land plants, Macmillan.
4. Butler & Jones - Plant pathology, Macmillan.
5. Campbell - Evolution of land plants, Stanford Univ. Press.
6. Chapman - Introduction to study of Algae, Macmillan.
7. Cochrane - Physiology of fungi, Willey.
8. Fritsch: Structure and reproduction in Algae, Vol. I & II. Cambridge University Press.
9. Singh - Plant diseases, Oxford & IBH.
10. Smith - Cryptogamic Botany Vol. I & II. McGraw Hill.
11. Kumar, H.D. 1988. Introductory Phycology. Affiliated East-West Press Ltd.
12. Morris, I. 1986. An introduction of Algae. Cambridge University Press U.K.
13. Prescott, G. W. 1984. Algae: A review, Bishan Singh Mahendra Pal Singh, Dehradun.
14. Trainer, F.R. 1978. Introductory Phycology. John Wiley and Sons. Inc
15. Mehrotra, R.S. and K.R. Aneja. 1999. An introduction to Mycology. New Age International Publisher.

1st Semester

M.Sc. BOTANY

SEMESTER-I

Core Course MBT-CC-T3-102

Cell & Molecular Biology

Course	Title	Credit	Marks	ES	IA	L	T	P
CC-102	Cell & Molecular Biology	3	100	70	30	3	1	0

CELL BIOLOGY: (Marks : 30)

Unit 1: 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 (Marks 15)

Unit 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 (Marks 15)

MOLECULAR BIOLOGY: (Marks : 40)

Unit 1 : DNA replication: semiconservative, enzymology of DNA replication; Basic concept of end replication problem and DNA synthesis by reverse transcriptase; C-value paradox, regulation of gene expression in 'prokaryotes'; transposons and retrotransposons, Nucleosome and chromatin structure, circular DNA replication, Operon concept, structure and function of lac operon. (Marks 15)

Unit 2: Transcription and Translation: RNA polymerase in 'prokaryotes' and eukaryotes; RNA transcription; RNA processing & splicing; Genetic code and its features; initiation, elongation and termination of protein biosynthesis; Epigenetics, RNA interference (Marks 15)

Unit 3: Basic methodologies of manipulating DNA & Genes: Cutting, separating and visualizing DNA pieces, Southern blotting, RFLP, DNA sequencing, polymerase chain reaction (PCR). (Marks 10)

REFERENCES:

1. Karp, J.G. (2007) Cell and Molecular Biology. John Wiley & Sons, USA.
2. Buchanan, B.B., Gruissem, W. and Jones, R.L. (2015). Biochemistry and molecular biology of plants. Wiley Publisher; pages: 1264p
3. Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K. and Watson, J.D. (2010). Molecular Biology of the cell. Garland publishers, Oxford.
4. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. John Wiley & Sons. Inc. New Delhi, India.
5. Gupta, P.K. (2005). Cell and Molecular Biology. Rastogi publications, Meerut, India.
6. Johnson, A., Lewis, J., Raff, M. (2007). Molecular Biology of the Cell. Garland Science, USA.
7. DeRobertis, E.D.P. and De Robertis, E.M.F. 2001. Cell and Molecular Biology, Lippincott Williams & Wilkins, Bombay.
8. Roy, S.C. and Kumar, K.D.C. 1977. cell Biology, New Central Book Agency, Calcutta.

1st Semester

M.Sc. BOTANY
SEMESTER-I
Core Course MBT-CC-T3-103
Environmental Biology

Course	Title	Credit	Marks	ES	IA	L	T	P
CC-103	Environmental Biology	3	100	70	30	3	1	0

ENVIRONMENTAL BIOLOGY:

Unit 1: Scope of ecology; concepts of limiting factors; nutrient cycling with special reference to carbon, nitrogen & phosphorus cycles. (Marks 10)

Unit 2: Ecosystem dynamics and management: diversity, stability and complexity of ecosystem, energy flow concept and methods of measurement of productivity. (Marks 20)

Unit 3: Population dynamics: population attributes, biotic potential and environmental resistance, population growth forms, survivorship curves, age structure, population fluctuations, interactions and regulation of population; concept of ecological niche, niche width and overlap, fundamental and realized niche; concept of meta population, demes and dispersal. (Marks 20)

Unit 4: Environmental degradation and management: Global environmental issues (deforestation, green house effect, depletion of ozone layer); Concept of EIA; Use of GPS, GIS and remote sensing in environmental management. (Marks 20)

References :

1. Smith, R.LI 996 Ecology and Field Biology Harper Collins, New York
2. Odum, E.P. (2011). Fundamental of Ecology. 5th Edition. Saunders. ISBN 9780030584145. 613 pages.
3. Chapman, J.L. and Reiss, M.J. (2003). Ecology: Principles and Applications. Second Edition. Cambridge University Press, UK. ISBN 0 521 58802 2. 335 pages.
8. Singh, J.S., Singh, S.P. and Gupta, S.R. (2006). Ecology, Environment & Resource Conservation. Anamaya Publishers. ISBN 978 8188342556. 688

1st Semester

M.Sc. BOTANY SEMESTER-I

Core Course MBT-CP-P3-104

Lab Course on CC (101-103)

Course	Title	Credit	Marks	ES	IA	L	T	P
CC-104	Lab Course on CC (101-103)	3	100	100	0	0	0	8

Phycology, Mycology & Plant Pathology:

1. Working out the following Algae for studying the external morphology and anatomy with special emphasis in reproductive structures present: *Ulothrix*, *Cladophora*, *Vaucheria*, *Ectocarpus*, *Fucus*, *Batrachospermum*, *Polysiphonia*, *Oscillatoria*, *Nostoc*.
2. Working out the following fungi for studying the external morphology and anatomy with special emphasis in reproductive structures present: *Rhizopus*, *Peziza*, *Ascobolus*, *Morchella*, *Puccinia*, *Polyporus*, *Agaricus*, *Auricularia*, *Helminthosporium*,
3. Study of symptoms of vegetative and reproductive structures and collection of the pathogens with the fresh and preserved specimens, Herbaria, semi-permanent/permanent slides of the following diseases: Blights of potato, Brown spot of rice, rusts of wheat, Grey blight of tea (*Pestalotiopsis*), Bean rust (*Uromyces*), White rust of *Brassica* (*Albugo*), Gall of coriander (*Protomyces*), *Alternaria* diseases of *Crucifers*.
4. Measurement of reproductive structures under microscope and Camera Lucida drawing.
5. Preparation of permanent slides for submitting in the examination.
6. Collection and preservation of specimens for submission (herbarium and bottle specimens)

Cell Biology, Molecular Biology:

1. Fixation, block preparation, sectioning and staining of tissues.
1. Isolation and quantification of RNA.
2. Isolation and quantification of DNA.
3. Isolation and quantification of Proteins.
4. To study chromosomal banding pattern.
5. Digestion of DNA using restriction endonucleases, Resolution and molecular weight estimation of fragmented DNA using agarose gel electrophoresis.
6. Amplification of known DNA sequences by PCR

Ecology:

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.

1st Semester

M.Sc. BOTANY SEMESTER-I

Ability Enhancement Course MBT-AE-T2-101

Principles of Ethnobotany

Course	Title	Credit	Marks	ES	IA	L	T	P
AE-101	Principles of Ethnobotany	2	50	35	15	2	1	0

ETHNOBOTANY:

Unit 1: Ethnobotany & related issues: Definitions. Scope and functions. History and development of Ethnobotany, Major issues related to ethnobotany (Ethical, Cultural, Social) (Marks 5)

Unit 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). (Marks 5)

Unit 3: Methodology of ethnobotanical studies: Field work and collection of data, Herbarium preparation and identification of plants, Temples and sacred places as sources of data and plant conservation. (Marks 10)

Unit 4: Role of ethnobotany: Primary health care programmes, Ethnobotany on development and conservation on bioresources. Significance of the following plants in ethnobotanical practices - *Calamus*, *Calotropis*, *Citrus*, *Dioscorea*, *Kayea*, *Livistonia*, *Terminalia*, *Zingiber*, *Curcuma*, *Tinospora*. (Marks 8)

Unit 5: Legal aspects in Ethnobotany: Concept of RET taxa, Role of IUCN and BSI in conservation, Biopiracy, Intellectual Property Rights with reference to Traditional Knowledge, Biodiversity laws in India. (Marks 7)

References:

1. Jain. S.K. (1989 Ed.) Method of Approaches in Ethnobotany. Lucknow.
2. Jain. S.K. (1989 Ed.) A Manual of Ethnobotany. Jodhpur.
3. Jain. S.K. & V. Mudgal (1999) A handbook of Ethnobotany. Dehradun.
4. Jain, S. K. (Ed.). 1981. Glimpses of Indian Ethnobotany. Oxford & IBH Jain, S. K. 1995. A Manual of Ethnobotany. Scientific Publishers.
5. Trivedi P C, 2006. Medicinal Plants: Ethnobotanical Approach, Agrobios, India.
6. Purohit and Vyas, 2008. Medicinal Plant Cultivation: A Scientific Approach, 2ndedn. Agrobios, India.

1st Semester**M.Sc. BOTANY
SEMESTER-I****Discipline Specific Elective Course MBT-DS-T4-101A****Taxonomy of Angiosperms-I**

Course	Title	Credit	Marks	ES	IA	L	T	P
DS-101A	Taxonomy of Angiosperms-I	4	100	70	30	3	1	0

Unit-1: **Basics of Taxonomy:** Concept, Aims and Principles, 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. (Marks 10)

Unit-2: **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. (Marks 10)

Unit-3: **Taxonomic Structure:** Concept of Taxa; Concept of Species, Genus, Family and Infra specific categories. (Marks 8)

Unit-4: **Material basis of Taxonomy:** Concept of Character; Character Correlation, Weighing, Variations; Isolation and Speciation. (Marks 12)

Unit-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. (Marks 15)

Unit-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. (Marks 15)

1st Semester**M.Sc. BOTANY
SEMESTER-I****Discipline Specific Elective Course MBT-DS-P2-102A
Taxonomy of Angiosperms-I**

Course	Title	Credit	Marks	ES	IA	L	T	P
DS-102A	Lab Course on DS-101A	2	50	50	0	0	0	4

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.)

1st Semester

M.Sc. BOTANY SEMESTER-I

Discipline Specific Elective Course MBT-DS-T4-101B Cytogenetics & Plant Breeding-I

Course	Title	Credit	Marks	ES	IA	L	T	P
DS-101B	Cytogenetics & Plant Breeding - I	4	100	70	30	3	1	0

CYTOGENETICS:

Unit1: Cell theory and exceptions, Gross structure and chemistry of eukaryotic and prokaryotic chromosomes, specialized chromosomes and their cytogenetic significances, mitotic apparatus. Synaptenemal complex, chromosome theory of inheritance, concept of karyotype and idiogram. (Marks 15)

Unit 2: Polygenic inheritance: concept, examples of inheritance of kernel colour of wheat, corolla length in tobacco, Monogenic vs polygenic inheritance. (Marks 15)

Unit 3: Multiple alleles: alleles, multiple alleles and isoalleles, blood group alleles in man, multiple alleles and complex loci. (Marks 10)

Unit 4: Linkage, recombination and gene mapping: Morgan's works on Drosophila, Coupling and repulsion hypothesis, gene mapping, interference and coincidence. (Marks 12)

Unit 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. (Marks 10)

Unit 6: Plant Breeding: Introduction and objectives, breeding systems: modes of reproduction in crop plants, important achievements and undesirable consequences of plant breeding. (Marks 8)

1st Semester**M.Sc. BOTANY****SEMESTER-I****Discipline Specific Elective Course MBT-DS-P2-102B****Lab Course on DS-102A**

Course	Title	Credit	Marks	ES	IA	L	T	P
DS-102B	Lab Course on DS-102A	2	50	50	0	0	0	4

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. Study of mitosis by squash techniques using acetoorcein techniques etc. in plant materials (squash from root tips or shoot tips of common economic and crop plants).
3. Study of meiosis by smearing techniques using suitable stains. in plant materials (smear from PMC's of common economic and crop plants).

1st Semester

M.Sc. BOTANY SEMESTER-I

Discipline Specific Elective Course MBT-DS-T4-101C Plant Ecology-I

Course	Title	Credit	Marks	ES	IA	L	T	P
DS-101C	Plant Ecology-I	4	100	70	30	3	1	0

PRINCIPLES AND CONCEPTS OF PLANT ECOLOGY:

Unit 1: Definition, division of plant ecology, tools used in studying ecosystem diversity and complexity, environmental monitoring; development of plant ecology at national and international level. (Marks 10)

Unit 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. (Marks 15)

Unit 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. (Marks 12)

Unit 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. (Marks 13)

Unit 5: Soil and plant relationship: soil formation, soil horizons, physico – chemical properties of soil, 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. (Marks 10)

Unit 6: 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. (Marks 10)

1st Semester

M.Sc. BOTANY
SEMESTER-I
Discipline Specific Elective Course MBT-DS-P2-102C
Plant Ecology-I

Course	Title	Credit	Marks	ES	IA	L	T	P
DS- 102C	Lab Course on DS-101C	2	50	50	0	0	0	4

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 Importance Value Index (IVI) of species in different stands.
5. To study the Species Diversity Index (SDI) in a grassland community.
6. To study the Leaf Area Index (LAI) of different species in a community.
7. To study the Stomatal Index (SI) of some species growing in various habitats.
8. To determine the Association Index (AI) of species in different habitats.
9. To determine the Similarity Index (SI) and Dissimilarity Index (DI) of species in different habitats.

2nd Semester

M.Sc. BOTANY
SEMESTER-II
Core Course MBT-CC-T3-201

Bryophytes, Pteridophytes and Gymnosperms

Course	Title	Credit	Marks	ES	IA	L	T	P
CC-201	Bryophytes, Pteridophytes and Gymnosperms	3	100	70	30	3	1	0

Bryophytes: (Marks : 14)

Unit 1: Classification and comparative study of morphology, anatomy and reproduction of Hepaticopsida, Anthocerotopsida and Bryopsida. Dehiscence and spore dispersal mechanisms; Ecological and economic importance. (Marks 8)

Unit 2: Origin, evolution and interrelationship of bryophytes, evolution of sporophytes of bryophytes, fossil bryophytes. (Marks 6)

Pteridophytes: (Marks : 28)

Unit 1: General characteristics, morphology, anatomy, reproduction and classification of Pteridophytes; Economic Importance of Pteridophytes (Marks 6)

Unit 2: Origin and evolution of Pteridophytes; Telome concept; Evolution of stele and stelar system; heterospory and origin of seed habit; Introduction to Psilopsida, Lycopsida, Sphenopsida and Pteropsida. (Marks 12)

Unit 3: General account of major fossil groups - Psilophytales, Sphenophyllales, Calamitales, Coenopteridales. (Marks 10)

Gymnosperms: (Marks : 28)

Unit 1: Introduction to gymnosperms, general characters, life cycle, diversity and origin and evolution of gymnosperms, Distribution of gymnosperms in India with special reference to N.E. India. Economic and ecological importance of gymnosperms. (Marks 12)

Unit 2: Classification and salient features of major taxa; characteristics, affinities and relationships of Ginkgoales, Coniferales, Taxales and Gnetales. (Marks 8)

Unit 3: Paleobotany: Study of *Calymatotheca*, *Cycadeoidea* and *Cordaites*. (Marks 8)

References:

1. Coulter & Chamberlain - Morphology of Gymnosperms, Chicago Uni.Press.
2. Kakkan&Kakkan - The Gymnosperms (Fossils & Living), CentralPub.House.
3. Mukherjee, Das, Ganguly - College Botany Vol. II, Central BookDepot.
4. Watson - Bryophyta, Hutchinson Univ. Library.
5. Parihar, N.S. 1991. Bryophyta. Central Book Depot, Allahabad.
6. Puri, P. 1980. Bryophytes. Atma Ram & Sons, Delhi
7. Ram Udar. Fifty years of Bryology in India. Golden Jubilee Series. IBS, New Delhi
8. Smith, G.M. 1955. Cryptogamic Botany. Vol. 1 and 11. Tata McGraw Hill, New Delhi.
9. Parihar, N.S. 1996. Biology and Morphology of Pteridophytes. Central Book Depot Allahabad
10. Sporne, K.R. 1991. The Morphology of Pteridophytes. Hutchinson Library Series London
11. Bhatnagar S.P. and Moitra A 1996. Gymnosperms New Age International, Pvt Ltd (P) New Delhi
12. Vashishta, P.C., Sinha A.K. and Kumar Anil.2012. Botany for degree students: Gymnosperm. S. Chand, New Delhi
13. Schofield, W.B. (1985). Introduction to Bryology. Macmillan .ISBN, 0029496608, 9780029496602.
14. Vanderpoorten, A. and Goffinet, B. (2009). Introduction to bryophytes. Cambridge University Press, Cambridge .ISBN 978-0-521-70073-3.
18. Mehlereter, K., Walker, L.A. and Sharpe, J.M. (2010). Fern Ecology. Cambridge University Press, Cambridge

2nd Semester

M.Sc. BOTANY
SEMESTER-II
Core Course MBT-CC-T3-202

Morphology & Taxonomy of Angiosperm

Course	Title	Credit	Marks	ES	IA	L	T	P
CC-202	Morphology & Taxonomy of Angiosperm	3	100	70	30	3	1	0

Morphology of Angiosperms: (Marks 12)

Unit 1: Detail study of (i) Origin of angiosperms, (ii) Inflorescence - types and evolution, (iii) Carpel polymorphism, (iv) Phyllode theory, (v) Role of morphology in the classification of the flowering plants. (Marks 12)

Taxonomy of Angiosperms: (Marks 58)

Unit 1: Origin and evolution of angiosperms; general principles of angiosperm phylogeny, evolutionary trends in angiosperms, taxonomic hierarchy and different taxonomic categories (Marks 10)

Unit 2: Principles of taxonomy, characters considered before plant identification; identification keys, floral formula and floral diagram. Salient features of ICN (formerly ICBN). Names according to rank, Author's citation, Priority, Type method, Some important rules of nomenclature. (Marks 8)

Unit 3: Systems of angiosperm classification: Natural, Artificial, Phylogenetic, APG system of classification; Relative merits and demerits of major systems of classification. Taxonomic evidence: Morphology, anatomy, palynology, embryology, cytology; Modern trends in plant taxonomy: Numerical taxonomy, Chemotaxonomy, Biosystematics. (Marks 10)

Unit 4: Herbarium and botanical garden: purpose, techniques of herbarium specimen preparation, major Indian herbaria and botanical gardens. (Marks 10)

Unit 5: Study of following families with particular reference to systematic position, phylogeny, evolutionary trends and economic importance. Dicot families; Magnoliaceae, Meliaceae, Fabaceae, Brassicaceae, Cucurbitaceae, Apiaceae, Lamiaceae, Verbenaceae, Euphorbiaceae, Asteraceae. (Marks 10)

Unit 6: Study of following families with particular reference to systematic position, phylogeny, Evolutionary trends and economic importance, Monocot families- Musaceae, Zingiberaceae, Cyperaceae, Poaceae, Orchidaceae (Marks 10)

References:

1. Mukherjee, Das, Ganguly - College Botany Vol. II, Central Book Depot.
2. Principles of Angiosperm Taxonomy - by P.H. Devid & V.H. Heywood, Oliver & Boyd, London, Scott - Fossil Botany, Vol. I & II.
3. Taxonomy of vascular plants - by H.M.G. Lawrence, McMillan, N.Y., 1964.
4. Families of flowering plants Vol. I & II, by J. Hutchinsons, McMillan, London, 1967
5. Davis, P.H. and Heywood, V.M. 1973. Principles of Angiosperm Taxonomy.
6. Grant, W.F. 1984. Plant Biosystematics. Academic Press, London.
7. Heywood, V.H. and Moore, D.M. 1984. Current Concepts in Plant Taxonomy. Academic Press. London.
8. Radford, A.E. 1986. Fundamentals of Plant Systematics, Harper & Row Publ. USA.
9. Stace, C.A. 1989. Plant Taxonomy and Biosystematics (2nd ed.) Edward Arnold Ltd. London.
10. Takhtajan, A.L. 1997. Diversity and Classification of Flowering Plants. Columbia Univ. Press, New York.
11. Nordenstam, B., El Gazaly, G. and Kassas, M. 2000. Plant Systematics for 21st Century. Portland Press Ltd. London
12. Singh, G. 2005. Plant Systematics: Theory and Practices (2nd Ed.) Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi
13. Sambamurty, A.V.S.S. 2005. Taxonomy of Angiosperms. I.K. International Pvt. Ltd., New Delhi.
15. Naik, V.N. 2006. Taxonomy of Angiosperms. Tata McGraw Hill Education Pvt. Ltd. New Delhi.
16. Sharma, O.P. 2009. Plant Taxonomy. Tata McGraw Hill Education Pvt. Ltd. New Delhi.
17. Verma, B.K. 2011. Introduction to Taxonomy of Angiosperms. PHI Learning Pvt. Ltd. New Delhi

2nd Semester

M.Sc. BOTANY
SEMESTER-II
Core Course MBT-CC-P4-203
Lab Course on CC (201&202)

Course	Title	Credit	Marks	ES	IA	L	T	P
CC-203	Lab Course on CC (201-202)	4	100	100	0	0	0	8

Bryophytes, Pteridophytes and Gymnosperms

1. **Bryophytes:** Working out the following Bryophytes for studying the external morphology and anatomy with special emphasis in reproductive structures present: *Riccia*, *Marchantia*, *Porella*, *Anthoceros*, *Sphagnum*, *Polytrichum*, *Funaria*
2. **Pteridophytes:** Study of *Psilotum*, *Selaginella*, *Isoetes*, *Equisetum*, *Ophioglossum*, *Pteris*, *Angiopteris*, *Lygodium*, *Gleichenia*, *Marsilea*, *Azolla*.
3. **Gymnosperms:** Working out the following specimens belonging to Gymnosperms for studying the external morphology and anatomy with special emphasis in reproductive structures present in *Cycas*, *Pinus*, *Ginkgo*, *Taxus*, *Cryptomeria*, *Ephedra*, *Gnetum*.

Angiosperm Taxonomy

1. Drawing, description and identification of plant specimens from selected group of families.
2. Identification of unknown plants with the help of keys from different floras and manuals.
3. Preparation of taxonomic keys at family, generic and species level based on locally available plants.
4. Chemotaxonomic variation in plant families.
5. Classification of plants based on numerical taxonomic characters.

2nd Semester

M.Sc. BOTANY
SEMESTER-II
Core Course MBT-CC-T4-201

Research Methodology

Course	Title	Credit	Marks	ES	IA	L	T	P
GE-201	Research Methodology	4	100	70	30	3	1	0

Unit 1: General principles of research Meaning, definition, objectives and characteristics of research, criteria of good research, significance of research, research process, research methods and methodology, Types of research- basic research (fundamental research), applied research, action research, descriptive research, analytical research, evaluation research, historical research, exploratory research, review of literature, interpretation of results and discussion. (Marks 20)

Unit 2 : Technical writing: Scientific writing that includes the way of writing Synopsis, research paper, poster preparation and presentation, and dissertation. (Marks 14)

Unit 3 : Web-based literature search engines: Introduction to Web Sciences, Google Scholar and PubMed, Impact factor metrics, Reviewing process of Journals. (Marks 10)

Unit 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 (Marks 14)

Unit 5 : Data analysis using Excel and R-tool: Analysis of quantitative data and presentation with tables, graphs etc., Use of Excel for Formulae Function, Charts and Graphs, Table formula, t-test, Anova and Correlation. Basics of working with R. (Marks 12)

References:

1. Gupta, S. (2005). Research methodology and statistical techniques. Deep & Deep Publications (p) Ltd. New Delhi.
2. Kothari, C.R. (2008). Research methodology (s). New Age International (p) Limited. New Delhi.

2nd Semester

M.Sc. BOTANY SEMESTER-II

Discipline Specific Elective Course MBT-DS-T4-201A

Taxonomy of Angiosperms-II

Course	Title	Credit	Marks	ES	IA	L	T	P
DS-201A	Taxonomy of Angiosperms-II	4	100	70	30	3	2	0

Unit-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. (Marks 14)

Unit-2: **Flora of North East India**: Characteristics of flora of Northeast India; Endemic, Exotics and RET Plants of North East India, their multiplication and conservation. (Marks 12)

Unit-3: **Botanical Survey of India**: History, Activities, Publications. (Marks 10)

Unit-4: **Origin and Evolution**: Characteristic features of early Angiosperms; Origin of Angiosperms, Primitive and advanced angiosperms; Evolutionary trends in Angiosperms. (Marks 14)

Unit-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. (Marks 20)

2nd Semester

M.Sc. BOTANY
SEMESTER-II
Core Course MBT-DS-P2-202A
Lab Course based on DS-201A

Course	Title	Credit	Marks	ES	IA	L	T	P
DS-202A	Lab Course based on DS-201A	2	50	50	0	0	0	4

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.

2nd Semester

M.Sc. BOTANY
SEMESTER-II
Core Course MBT-DS-T4-201B
Cytogenetics & Plant Breeding-II

Course	Title	Credit	Marks	ES	IA	L	T	P
DS-201B	Cytogenetics & Plant Breeding-II	4	100	70	30	3	2	0

Mutation and Plant Breeding:

Unit 1: Mutation: (a) at chromosomal level: euploidy and aneuploidy, deletion, duplication, translocation and cytogenetics and breeding behaviour of translocation heterozygote and deficiency, position effect, induction of polyploidy; DNA damage and repair, (b) at biochemical level: One gene - one enzyme hypothesis, biochemical mutation in *Neurospora*.

(Marks 20)

Unit 2: Genetic basis of plant breeding: Genetic consequences of hybridization, distant hybridization, Hardy Weinburg Law, choice of breeding methods.

(Marks 10)

Unit 3: Breeding procedure for self pollinated, cross pollinated and vegetatively propagated plants, mutation and ploidy breeding including haploidy in crop improvement, types of hybrids and development of hybrid seeds.

(Marks 12)

Unit 4: 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.

(Marks 16)

Unit 5: Conventional breeding methods: Pedigree, mass selection, polyploidy in higher plants, mutation in crop improvement, IPR related issues, plant variety protection and farmers right.

(Marks 12)

2nd Semester

M.Sc. BOTANY
SEMESTER-II
Core Course MBT-DS-P2-201B
Lab Course based on DS-201B

Course	Title	Credit	Marks	ES	IA	L	T	P
DS-201B	Lab Course on DS-201B	2	50	50	0	0	0	4

1. Application of Colchicine for chromosome doubling in suitable plant species.
2. C- Metaphase and counting of chromosomes, karyotype studies and preparation of idiograms.
3. Study of anaphasic separation; chromosomal breakage, laggard, chromatin bridge and unequal separation.
4. Floral biology study, techniques of emasculation, selfing and hybridization techniques.

2nd Semester

M.Sc. BOTANY
SEMESTER-II
Core Course MBT-CC-T4-201C
Plant Ecology-II

Course	Title	Credit	Marks	ES	IA	L	T	P
DS-201C	Plant Ecology-II	4	100	70	30	3	2	0

HABITAT ECOLOGY

- Unit1: 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. (Marks 10)
- Unit 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. (Marks 10)
- Unit 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. (Marks 12)
- Unit 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. (Marks 12)
- Unit 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. (Marks 12)
- Unit 6: Deep ecology: definition, deep ecology platform, development, sources of deep ecology, deep ecology movement, misconception in deep ecology, criticism of deep ecology, links with other philosophies. (Marks 14)

2nd Semester

M.Sc. BOTANY
SEMESTER-II
Core Course MBT-DS-P2-201C
Lab Course based on DS-201C

Course	Title	Credit	Marks	ES	IA	L	T	P
DS- 201C	Lab Course on DS-201C	2	50	50	0	0	0	4

- 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 productivity of plants by leaf – disc–method.
- 4.To study the effect of sampling size on the vegetation analysis.
- 5.To study the texture, colour, humus and organic matter content in different soil samples.
- 6.To determine the moisture content, bulk density, porosity, and water holding capacity of different soil samples.
- 7.Estimation of total nitrogen content in different soil samples.
- 8.Estimation of phosphorous content in various soil samples.

3rd Semester

M.Sc. BOTANY

SEMESTER-III

Core Course MBT-CC-T3-301

Cytogenetics and Plant Breeding

Course	Title	Credit	Marks	ES	IA	L	T	P
CC-301	Cytogenetics and Plant Breeding	3	100	70	30	3	1	0

Unit 1: Mendel's experiments and principles of inheritance; backcross and test cross; gene interactions and modified dihybrid ratios — complementary, supplementary, duplicate and epistatic factors. (Marks 13)

Unit 2. Sex chromosomes and mechanisms of sex determination; sex linked inheritance in Drosophila and man. (Marks 12)

Unit 3: Extranuclear transmission of traits; maternal effect and maternal inheritance, Cytoplasmic inheritance with reference to Kappa particles in Paramecium; Plastid inheritance in Mirabilis jalapa, Petit yeast, CO₂ sensitivity in Drosophila, Coiling. (Marks 15)

Unit 4: Structural and numerical aberrations involving chromosomes; Spontaneous and induced mutations; mutagens — types and mode of action; transitions, transversions and frame-shift mutations; Hereditary defects - Klinefelter, Turner, Cri-du-Chat, Down syndromes, Sickle cell anemia. (Marks 15)

Unit 5: Methods of plant improvement: Introduction and acclimatization; Pure line and mass selection; hybridization, hybrid vigour and applications, genetic basis of inbreeding depression

(Marks 15)

3rd Semester

M.Sc. BOTANY
SEMESTER-III
Core Course MBT-CC-T2-302
Microbiology

Course	Title	Credit	Marks	ES	IA	L	T	P
CC-302	Microbiology	2	50	35	15	2	1	0

Unit 1: Microbial diversity: ‘Species’ and ‘Strain’ concept in microbiology, ICN for virus, bacteria and other microbes, microbiome concept, ecological significance of microbes, microbiology of soil, air, water and milk. (Marks 15)

Unit 2: Microbial techniques: sterilization techniques, population estimation (direct spore count, CFU, spectrophotometric method), pure culture and visualization techniques, culture preservation and maintenance, taxonomic and functional characterization of microbes. (Marks 15)

Unit 3: Microbial genetics & Physiology: Mode of reproduction (vegetative, asexual & sexual), genetic recombination, mode of nutrition, growth conditions and nutritional requirements, different metabolic pathways (respiratory and photosynthetic). (Marks 15)

Unit 4: Applied microbiology: Application of microbes in the field of agriculture, fermented foods. (Marks 5)

3rd Semester

M.Sc. BOTANY SEMESTER-III

Core Course MBT-CC-P4-303

Lab Course on CC (301 & 302)

Course	Title	Credit	Marks	ES	IA	L	T	P
CC-303	Lab Course on CC (301&302)	3	100	100	0	0	0	6

Cytogenetics and Plant Breeding

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.
3. Study of meiosis of some aberrant plants.
4. Emasculation and hybridization

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

3rd Semester

M.Sc. BOTANY
SEMESTER-III
Core Course MBT-AE-T2-301
Tools and Techniques in Biology

Course	Title	Credit	Marks	ES	IA	L	T	P
AE - 301	Tools and Techniques in Biology	2	50	35	15	2	1	0

Unit 1: Detection of molecules by using ELISA, RIA, immunoprecipitation, GISH, FISH

(Marks 18)

Unit 2: Molecular structure determination using light scattering, XRD & NMR, Protein sequencing methods, strategies of genome sequencing, microarray based techniques.

(Marks 16)

Unit 3: Image processing methods in microscopy- SEM, TEM, molecular imaging of radioactive material, ECG, MRI.

(Marks 16)

3rd Semester

M.Sc. BOTANY
SEMESTER-III
Core Course MBT-GE-T4-301

Plant Tissue Culture

Course	Title	Credit	Marks	ES	IA	L	T	P
GE - 301	Plant Tissue Culture	4	100	70	30	3	1	2

Plant Tissue Culture (Theory)

Marks : 50

Unit 1: General introduction, History and Scope, Concept of cellular differentiation and totipotency, laboratory Organization; media preparation and sterilization techniques, Nutrition of plant tissues. (Marks 10)

Unit 2: Role of Micro- & Macro-nutrients in Plant Tissue Culture, Role of phytohormones in plant development in vitro Culture initiation (Marks 10)

Unit 3: Micropropagation, Types of Culture- Embryo culture, Endosperm culture, pollen/anther culture along with their role, Synthetic seeds, somaclonal variation, somatic embryogenesis, protoplast fusion and somatic hybridization, transgenesis. (Marks 15)

Unit 4: Applications of plant tissue culture in agriculture, horticulture and forestry, and in the production of certain secondary metabolites/natural products. (Marks 15)

Plant Tissue Culture (Practical)

Marks : 20

1. Demonstration on different types of tools use in plant tissue culture
2. Sterilization techniques and prevention strategies to avoid contamination in plant tissue culture room/media.
3. Media preparation: various media used in *in vitro* culture techniques and sterilization.
4. Practical demonstrations on explant preparation and initiation of Culture and sub-culture, Embryo culture.
5. Demonstration of plant regeneration from callus culture

3rd Semester

M.Sc. BOTANY SEMESTER-III

Discipline Specific Elective Course MBT-DS-T4-301A

Taxonomy of Angiosperms-III

Course	Title	Credit	Marks	ES	IA	L	T	P
DS-301A	Taxonomy of Angiosperms-III	4	100	70	30	3	1	0

Unit 1: Sources of Taxonomic Characters: Morphology, Anatomy, Palynology, Embryology, Cytology, Phytochemistry, Serology., major areas. (Marks 10)

Unit 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. (Marks 12)

Unit 3: Taxonomic Literature: Classical and recent literature of World in general and India in particular (World flora, Indian flora); Taxonomic journals, Icones, Check list, Illustrations (Marks 10)

Unit 4: 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. (Marks 12)

Unit 5: Study of following families with particular reference to systematic position, phylogeny, Evolutionary trends and economic importance, Monocot families- Musaceae, Zingiberaceae, Cyperaceae, Poaceae, Orchidaceae. (Marks 14)

Unit 6: Critical Review on some Selected Angiospermic families (Marks 12)

- Critical review/ discussion on primitiveness of the order Magnoliales - Ranales
- Critical review/ discussion on the phylogeny and affinities of the order Personales.
- Critical review/ discussion on advancement (systematic position)of the family Asteraceae.
- Critical review/ discussion on advancement (Phylogeny and Affinities)of the taxon Orchidales & Poales.

3rd Semester

M.Sc. BOTANY SEMESTER-I

Discipline Specific Elective Course MBT-DS-P2-302A Taxonomy of Angiosperms-III

Course	Title	Credit	Marks	ES	IA	L	T	P
DS-302A	Lab Course on DS-301A	2	50	50	0	0	0	4

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. Solving of nomenclatural problems based on the rules of ICBN.
5. Preparation of check list of the species of a genus following the Website of www.ipni.org/ipni/query_ipni.html; [www.britannica.com/EBchecked / topic/285218/Index-Kewensis](http://www.britannica.com/EBchecked/topic/285218/Index-Kewensis); and the recently published local floras and periodicals.
6. Familiarity with taxonomic literatures: Dictionaries, Glossaries, Manuals, Floras, Bibliographies.
7. Study of pollen grains sculpture and aperture by revised or modified acetolysis method.
8. 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.

3rd Semester

M.Sc. BOTANY SEMESTER-III

Discipline Specific Elective Course MBT-DS-T4-301B Cytogenetics & Plant Breeding-III

Course	Title	Credit	Marks	ES	IA	L	T	P
DS-301B	Cytogenetics & Plant Breeding-III	4	100	70	30	3	1	0

Unit1: Molecular genetics; Basic concepts of molecular genetic markers: viz. microsatellite, SNP, RAPD, AFLP, ISSR. (Marks 10)

Unit 2: Genome organization in viruses, prokaryotes and eukaryotes; organization of nuclear and organellar genomes; repetitive DNA, satellite DNAs and interspersed repeated DNAs; split genes, pseudogenes, overlapping genes and multigene families. (Marks 12)

Unit 3: Structure and processing of messenger RNA, transfer RNA, ribosomal RNA, small interfering RNAs and micro RNAs, regulation through RNA processing and decay, alternative splicing, mRNA stability. (Marks 12)

Unit 4: Enzymes in Genetic Engineering: Restriction endonuclease type I and II, Polynucleotide kinase, T4 DNA ligase, Nick translation system, Reverse transcriptase, Terminal deoxynucleotidyl transferase. (Marks 10)

Unit 5: Cloning in Recombinant DNA technology: Cloning vectors- Plasmid, Cosmid, Yeast Cloning Vector, Ti plasmid; Transformation (Bacteria and Plant), Selection and Screening of recombinants; Applications of recombinant DNA technology. (Marks 14)

Unit 6: Recombinant DNA technology: Importance of microorganisms in recombinant DNA technology; Basic steps in r DNA technology; uses of genetic engineering for human welfare. (Marks 12)

3rd Semester

M.Sc. BOTANY SEMESTER-III

Discipline Specific Elective Course MBT-DS-P2-302B Cytogenetics & Plant Breeding-III

Course	Title	Credit	Marks	ES	IA	L	T	P
DS-302B	Lab Course on DS-301B	2	50	50	0	0	0	4

1. Study of purity of seeds from commercial seed samples
2. Study of 'goodness of fit' by chi-square test with the help of Mendelian ratios
3. Demonstration of Media preparation and tissue culture techniques.
4. Study of the extent of genetic variability on different characters of crops by different genetic parameters like environmental etc
5. Preparation of 20 permanent slides representing various stages of somatic and meiotic division for submission during practical examination.

3rd Semester

M.Sc. BOTANY SEMESTER-III

Discipline Specific Elective Course MBT-DS-T4-301C

Plant Ecology-III

Course	Title	Credit	Marks	ES	IA	L	T	P
DS-301C	Plant Ecology-III	4	100	70	30	3	1	0

Unit 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; phytoremediation of environmental pollution. (Marks 10)

Unit 2: Environment Impact Assessment (EIA): Methods of EIA evaluation with special reference to adhoc method and check list method, role of various agencies in operation of an EIA programme. (Marks 10)

Unit 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. (Marks 10)

Unit 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. (Marks 10)

Unit 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. (Marks 15)

Unit 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. (Marks 15)

3rd Semester

M.Sc. BOTANY SEMESTER-III

Discipline Specific Elective Course MBT-DS-P2-302C

Plant Ecology-III

Course	Title	Credit	Marks	ES	IA	L	T	P
DS- 302C	Lab Course on DS-301C	2	50	50	0	0	0	4

1. To study the anatomical adaptative characters of hydrophytes, mesophytes and xerophytes.
2. To study the phenology and reproductive capacity of plants.
3. Determination of total solids (TS), Total Dissolved Solids (TDS), and Total Suspended Solids (TSS) of water by heat and weight method.
4. To study the total microbial population in rhizosphere soil.
5. To study the allelopathic / kairopathic action of plants on associated plants.
6. Phytochemical extraction of certain MAPs and their antimicrobial and antioxidant activity study.
7. To study the PH, turbidity, temperature and light intensity in a fresh water system.

4th Semester

M.Sc. BOTANY
SEMESTER-IV
Core Course MBT-CC-T4-401
Embryology and Anatomy

Course	Title	Credit	Marks	ES	IA	L	T	P
CC-401	Embryology and Anatomy	4	100	70	30	4	1	0

Unit 1: Male and female gametophyte: Microsporangium and Microsporogenesis, Megasporangium and Megaspores, Gametophyte formation, Pollen development, Ovule development.

(Marks 15)

Unit 2: Pollen-pistil interaction and double fertilization: Pollen tube guidance; recognition and rejection, Embryo-sac development and double fertilization in plants, preferential fertilization; pistil activation and ovule penetration.

(Marks 15)

Unit 3: Seed development and dormancy: Embryogenesis, Embryo development, endosperm development, Classification of typical dicot and monocot embryo, embryo-endosperm relationship, Seed structure, importance and dispersal mechanisms, seed maturation and dormancy, polyembryony, apomixis, apospory.

(Marks 20)

Unit 4: Plant tissue system: Meristems, their classification, functions, organization of root and shoot apices. Structure of xylem and phloem. Transition from root to stem. Primary and secondary growth, anomalous structure and abnormal secondary growth in stems. Application of anatomy in systematic, archaeology and climate change studies.

(Marks 20)

4th Semester

M.Sc. BOTANY
SEMESTER-IV
Core Course MBT-CC-P3-402

Course	Title	Credit	Marks	ES	IA	L	T	P
CC-402	Lab Course based on CC-401	3	100	100	0	6	0	0

Embryology & Anatomy:

1. Preparation of pollen grain slides by following different techniques.
2. Study of microsporogenesis, megasporogenesis, embryo sacs and endosperms with the help of permanent slides
3. Study of anomalous secondary growth of selective families of Angiosperms.
4. Study of developmental stages of leaf, stem and root.
5. Field study and visit to different Research Institutions/Universities/Centers/ Botanical Garden/ Herbaria within India.

4th Semester

M.Sc. BOTANY
SEMESTER-IV
Core Course MBT-CC-T4-403
Plant Physiology and Biochemistry

Course	Title	Credit	Marks	ES	IA	L	T	P
CC-403	Plant Physiology and Biochemistry	4	100	70	30	3	1	0

Unit 1: Plant Water relations: Water potential and its components, determination of water potential, Active and passive absorption of water, Apoplast and Symplast, Ascent of sap, passive and active solute transport. (Marks 10)

Unit 2: Essential elements and Physiological role of essential elements, Deficiency and toxicity symptoms, Hydroponics and its physiological significance (Marks 10)

Unit 3: Photosynthesis: Steps of photosynthesis Hill reaction, photosystem I and II, red drop and Emerson effect, Calvin cycle, Hatch and Slack pathway, CAM cycle, factors affecting photosynthesis, Photorespiration and its significance. (Marks 10)

Unit 4: Growth and development: Differentiation, growth phases; Physiology of flowering; Photoperiodism and vernalization; Phytochrome concept and role in flowering; Plant growth hormones: auxins, gibberellins, cytokinins, ethylene and abscissic acid and their physiological role; Senescence and abscission. (Marks 15)

Unit 5: Nitrogen fixation and metabolism: Biological nitrogen fixation, mechanism of nitrate uptake and reduction, ammonium assimilation. (Marks 10)

Unit 6: Structure, function and metabolism of carbohydrates, lipids, proteins, vitamins; Conformation and stability of proteins including secondary structure, Ramachandran plots, domains. (Marks 15)

4th Semester

M.Sc. BOTANY
SEMESTER-IV
Core Course MBT-CC-P3-404

Course	Title	Credit	Marks	ES	IA	L	T	P
CC-404	Lab Course based on CC-403	4	100	100	0	6	0	0

Plant Physiology and Biochemistry

1. Preparation of normal, molar, molal and ppm solutions
2. Extraction of proteins from plant materials and estimation by Lowry's method using BSA standard curve.
3. Extraction of carbohydrates from plant materials and estimation of reducing and non reducing sugars.
4. Extraction of oil/fat from plant materials
5. Extraction of plant phenols and estimation of total phenols.
6. Extraction of chloroplast pigments and quantitative estimation; Determination of chlorophyll a/b ratio and total chlorophyll in C3, C4 and CAM plants.
7. Separation of amino acid mixture by thin layer / paper chromatography.

4th Semester

**M.Sc. BOTANY
SEMESTER-IV**

Discipline Specific Elective Course MBT-DS-T6-401A

Taxonomy of Angiosperms -IV

Course	Title	Credit	Marks	ES	IA	L	T	P
DS-401A	Project Work: Plant Taxonomy-IV	6	120	120	0	0	0	0

Transaction Mode:

Evaluation Criterion	Max. Marks
Literature survey/ background information	20
Organization of content	5
Physical presentation	20
Question and Answer	15
Report evaluation	60
Total	120

4th Semester

**M.Sc. BOTANY
SEMESTER-IV**

**Discipline Specific Elective Course MBT-DS-T6-401B
Cytogenetics & Plant Breeding-IV**

Course	Title	Credit	Marks	ES	IA	L	T	P
DS-401B	Project Work: Cytogenetics & plant Breeding -IV	6	120	120	0	0	0	0

Transaction Mode:

Evaluation Criterion	Max. Marks
Literature survey/ background information	20
Organization of content	5
Physical presentation	20
Question and Answer	15
Report evaluation	60
Total	120

4th Semester

**M.Sc. BOTANY
SEMESTER-IV
Discipline Specific Elective Course MBT-DS-T6-401C
Plant Ecology-IV**

Course	Title	Credit	Marks	ES	IA	L	T	P
DS-401C	Project Work: Plant Ecology-IV	6	120	120	0	0	0	0

Transaction Mode:

Evaluation Criterion	Max. Marks
Literature survey/ background information	20
Organization of content	5
Physical presentation	20
Question and Answer	15
Report evaluation	60
Total	120