



ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

Guwahati

Course Structure and Syllabus

(From Academic Session 2020-21 onwards)

M.Sc. Botany (CBCS)

1st Semester



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Course Structure

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M.Sc. Botany (CBCS)

1ST SEMESTER

Sl. No.	Sub-Code	Subject	Hours per Week			Credit	Marks	
			L	T	P		C	CE
Theory								
Core								
1	MBY202C101	Phycology, Mycology & Lichenology	4	0	0	4	30	70
2	MBY202C102	Bryology, Pterology & Mycorrhiza	4	0	0	4	30	70
3	MBY202C103	Plant Tissue Culture & Genetic Engineering	4	0	0	4	30	70
Practical								
1	MBY202C114	Lab-I	0	0	8	4	30	70
2	MBY202C115	Lab-II	0	0	8	4	30	70
Optional (Any One Paper)								
1	MBY2021E11	Cell & Molecular Biology	3	0	0	3	30	70
2	MBY2021E12	Bio fertilizers & Mushroom Cultivation	3	0	0	3	30	70
Total			15	0	16	23	180	420
Total Contact Hours per week: 31								
Total Credits: 23								

Detailed Syllabus

Course Code	Course Title	Hours per week L-T-P	Credit C
MBY202C101	Phycology, Mycology & Lichenology	4-0-0	4

Objectives:

- To acquire knowledge on the structure, reproduction and life cycle of algae from lower form to advance groups.
- To study the classification, structure and reproductive features of fungi and lichens.

Phycology

12 lectures

Unit 1: General characteristics, Algal habitats, range of thallus organization, criteria for classification of algae-pigment system, reserve food (of only groups represented in the syllabus), flagella, methods of reproduction, Classification of algae by Fritsch, different types life cycle of algae, Algal blooms, algal bio fertilizers, Algae as food, feed & Industry.

16 lectures

Unit 2: Salient features, structure, reproduction and life cycle of Cyanophyta-Oscillatoria, Nostoc and Anabaena; Chlorophyta- Chlamydomonas, Chlorella, Ulothrix, and Oedogonium; Pheophyta- Laminaria, Fucus and Sargassam; Rhodophyta- Polysiphonia

Mycology

14 lectures

Unit 3: General characteristics of fungi, Affinities with plants and animals, mode of nutrition in fungi, reproduction (vegetative, asexual, sexual); heterothallism; heterokaryosis; parasexuality; Classification of fungi with special reference to Alexopoulos, Economic Importance of Fungi.

15 lectures

Unit 4: General characters, structure, reproduction and life cycle of Ascomycota-Saccharomyces, Aspergillus and Penicillum; Basidiomycota- Puccinia, Polyporus and Agaricus; Deuteromycota-Fussarium and Colletotrichum.

Lichenology

3 lectures

Unit 5: General features of Lichens, distribution, Classification (Miller), Distribution, thallus organization, vegetative & sexual reproduction, lichens as indicators of pollution & economic importance.

Textbooks/Reference books:

1. Fritsch, F.E.1972. Structure and Reproduction of Algae I & II, Cambridge University Press.
2. Gilbert Smith.1976. Cryptogamic Botany. Tata McGraw Hill Book Company Ltd, New Delhi.
3. Pandey.S.N., S.P.Misra and P.S. Trivedi. 2002. A Text book of Botany Volume II. Vikas Publishing House Pvt Ltd, New Delhi.
4. Sambamurthy A.V. S.S. 2005. A Text book of Algae. I.K. International Pvt.Ltd, New Delhi.

5. Sharma O.P, 2007; Text book of Algae; Tata Mcgraw – Hill Publications Pvt – New Delhi.
6. Sundara Rajan, S. 2005, Practical Manual of Algae; Anmol Publications Pvt New Delhi.
7. Vashishta. B.R., A.K. Sinha and Adarsh Kumar. 2008. Botany for Degree students - Algae. S. Chand and Company Ltd., New Delhi.
8. Lee, R.E. (2008). Phycology, Cambridge University Press, Cambridge. 4th edition.
9. Kumar, H.D. (1999). Introductory Phycology, Affiliated East-West Press, Delhi.
10. Sambamurthy A.V. S.S. 2006. A Textbook of Plant Pathology. I.K. International Pvt. Ltd., New Delhi.
11. Sharma, O.P.2005. The Text book of Fungi. Tata McGraw Hill publishing company Ltd, New Delhi.
12. Sharma, P.D.2009. The Fungi. Rastogi publications, Meerut.
13. Sharma, O. P. (1986). Textbook of Algae. Tata McGraw Hill, New Delhi. Smith, G. M. (1976).
14. Cryptogamic Botany. Vol. I. Algae and Fungi. Tata McGraw Hill, New Delhi.
15. Alexopoulos, C. J. and Mims, C. W. (1979). Introductory Mycology. Wiley Eastern Ltd., New York.
16. Bessey, E. A. (1979). Morphology and Taxonomy of Fungi. Vikas Publishing House Pvt. Ltd., New Delhi.
17. Bold, H. C. et al. (1980). Morphology of Plants and Fungi. Harper and Row Publishing Inc., New York. Burnet, J. H. (1971).
18. The Fundamentals of Mycology. ELBS Publications, London.
19. Mehrotra, R. S and Aneja, K. R. (1990). An Introduction of Mycology. Wiley Eastern Ltd., New Delhi.
20. Sharma, P. D. (1987). The Fungi. Rastogi and Co., Meerut.
21. Hale, M.E.Jr. (1983). Biology of Lichens. Edward Arnold, Maryland.

Course Code	Course Title	Hours per week L-T-P	Credit C
MBY202C102	Bryology, Pterology & Mycorrhiza	4-0-0	4

Objectives:

- To acquire knowledge on the characters, structure and reproduction of Bryophytes.
- To acquire knowledge on living and fossil forms of Pteridophytes.
- To study types, structure, distribution and role of mycorrhizha.

Bryology

12 lectures

Unit 1: General Characteristics & classification of bryophytes; Adaptation of land habit; Comparative study of different types of bryophytes (of only groups represented in the syllabus) by morphology, anatomy and sporophyte; Alternation of generations.

16 lectures

Unit 2: Distribution, classification, morphology, anatomy, and reproductive study of Riccia, Marchantia, Porella, Anthoceros, Funaria, Polytrichum.

Pterology

12 lectures

Unit 3: General characteristics & classification of pteridophytes; comparative study of different types of sporophytes; heterospory & seed habit of pteridophytes; stelar evolution in pteridophytes; apogamy & apospory.

18 lectures

Unit 4: Distribution, classification, morphology, anatomy, and reproductive study of Rhynia, Psilotum, Lycopodium, & Selaginella, Equisetum, Marsilea, Angiopteris & Polypodium.

Mycorrhiza

2 lectures

Unit 5: Definition, distribution, types of mycorrhiza, role of mycorrhiza in agriculture and forestry.

Textbooks/Reference books:

1. Gilbert Smith.1976. Cryptogamic Botany. Tata McGraw Hill Book company Ltd, New Delhi.
2. Pandey.S.N., S.P.Misra and P.S. Trivedi. 2002. A Text book of Botany Volume II. Vikas Publishing House Pvt Ltd, New Delhi.
3. Parihar, N.S.1991. An Introduction to Embryophyta – Bryophytes, Central Book Depot. Allahabad. 6. Rashid.A. 2007. An Introduction to Bryophyta – Vikas Publications, New Delhi.
4. Vashishta. B.R., A.K. Sinha and Adarsh Kumar. 2005. Botany for Degree students Bryophyta. S. Chand and Company Ltd., New Delhi.
5. Parihar, N.S. 1991, Bryophyta, Central Book Depot, Allahabad.
6. Watson, E. V. (1971). The Structure and Life of Bryophytes. B.I. Publications, New Delhi.
7. Smith, G. M. (1971). Cryptogamic Botany. Vol. II. Bryophytes and Pteridophytes. Tata McGraw Hill, New Delhi.

8. Parihar, N.S. 1996, Biology & Morphology of Pteridophytes, Central Book Depot, Allahabad.
9. Puri, P. 1980. Bryophytes, Atma Ram & Sons, Delhi.
10. Sporne, K.K 1991. The Morphology of Pteridophytes, B.I. Publishing Pvt Ltd, Bombay.
11. Pandey, B.P. 2006. College Botany-Volume –II. S.Chand & Company ltd, New Delhi.
12. Rashid.A. 2007. An Introduction to Pteridophyta –Vikas Publications, New Delhi.
13. Parihar,N.S. 2005.An Introduction to Embryophyta – Pteridophytes – Central Book Dep, Allahabad.
14. Dubey, R.C. (2008). A Textbook of Biotechnology. S. Chand & Co. Ltd., New Delhi.
15. Schwintzer, C.R. and Tjepkema, J.D. (1990). The Biology of Frankia and Actinorhizal Plants. Academic Press Inc., San Diego, USA.
16. Verma, A. (1999). Mycorrhiza. Springer Verlag, Berlin.

Course Code	Course Title	Hours per week L-T-P	Credit C
MBY202C103	Plant Tissue Culture & Genetic Engineering	4-0-0	4

Objectives:

- This paper provides an understanding of basic techniques for plant tissue culturing process.
- To acquire the knowledge of gene transfer techniques in plant.

10 lectures

Unit 1: Introduction-history, scope and basic techniques of in plant tissue culture, sterilization techniques – filter, heat, chemical, types of media in plant tissue culture (MS, Whites and Gamborg's media), preparation of media and its composition, plant growth regulators in plant tissue culture.

12 lectures

Unit 2: Types of culture - callus culture, embryo culture, ovule culture, pollen culture, anther culture, protoplast culture, embryo rescue, direct and indirect organogenesis, somatic embryogenesis, synthetic seeds, somatic hybrid and cybrids, acclimatization.

14 lectures

Unit 3: Definition, scope, applications and tools of genetic engineering, enzymes (exonuclease, endonuclease and restriction endonuclease), ligase, alkaline phosphatase, reverse transcriptase, DNA Polymerase, use of linkers and adaptors.

Cloning vectors-plasmids (pBR322, pUC), cosmid, YAC and BAC phage, Ti and Ri plasmid, gemini virus, tobamovirus.

14 lectures

Unit 4: Gene cloning-steps of rDNA technology, cDNA library, screening and selection of recombinants (blue-white selection, colony hybridization), blotting techniques (southern, northern and western), marker genes and reporter genes, DNA fingerprinting, PCR.

Methods of gene transfer: vector less gene transfer method - chemical method (polyethylene glycol mediated gene transfer), physical method (electroporation, gene gun, microinjection, Liposome mediated gene transfer), vector mediated gene transformation – CaMV, Gemini virus, and detailed study of agrobacterium mediated gene transformation.

10 lectures

Unit 5: Transgenic Plants- Bt cotton, golden rice, edible vaccine, flavor tomato, herbicide, insect, bacterial, viral and fungal resistance plants, terminator seeds.

Textbooks/Reference books:

1. Dubey, R. C. (2008). A Textbook of Biotechnology. S. Chand & Co. Ltd., New Delhi.
2. Gupta, P. K. (1994). Elements of Biotechnology. Rastogi and Co., Meerut.
3. Hammaond, J., McGarvey, P. and Yusibov, V. (2000). Plant Biotechnology. Springer Verlag, Berlin.
4. Satyanarayana, V. (2005). Biotechnology. Books and Allied (P) Ltd., Kolkata.
5. Singh, B. D. (1998). Biotechnology. Kalyani Publishers, New Delhi.
6. Primrose, S. B., Twyman, R. M. and Old, R. W. (2001). Principles of Gene Manipulation. Blackwell Science, London.
7. Smith, J.E. (2009). Biotechnology (5th Edition). Cambridge University Press India Pvt. Ltd., New Delhi.

8. Bernard B. Glick, Jack J. Pastunak. 2009. Molecular Biotechnology principles and application of Recombinant – DNA
9. Prasash M. and Arora. C.K.. 1998. Plant tissue culture, Ammol publication Pvt. Ltd.
10. Ignacimuthu, S.1997. Biotechnology: An Introduction-2nd Edition, Narosa Publishing House, New Delhi
11. Rastogi, S.C. 2007. Biotechnology- Principles and Applications. Narosa Publishing House, New Delhi.
12. Bhojwani, S. S. and Razdan, M. K. (1983). Plant Tissue Culture: Theory and Practice. Elsevier Science Publishers, Netherlands.
13. Kalyan Kumar, De. (1992). An Introduction to Plant Tissue Culture. New Central Book Agency, Calcutta.
14. Ramawat, K. G. (2000). Plant Biotechnology. S. Chand & Co., New Delhi
15. Razdan, M. K. (2004). Introduction to Plant Tissue Culture (2 nd ed.). Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
16. Reinert, J. and Bajaj, Y. P. S. (1977). Plant Cell Tissue and Organ Culture: A Laboratory Manual, Narosa Publishing House, New Delhi.
17. Vasil, I. K. (1986). Cell Culture and somatic Cell Genetics of Plants. 3 Volumes. Academic Press Inc., New York.

Course Code	Course Title	Hours per week L-T-P	Credit C
MBY202C114	Lab-I	0-0-8	4

Objectives:

- To observe the structure of Algae, Fungi, Bryophytes, Pteridophytes, Lichens and mycorrhiza.
- Sectioning, slide preparation and observation.

Algae: Oscillatoria, Nostoc, Anabaena, Chlamydomonas, Chlorella, Ulothrix, Oedogonium; Laminaria, Fucus, Sargassum and Polysiphonia.

Fungi: Saccharomyces, Aspergillus, Penicillium, Puccinia, Polyporus, Agaricus, Fusarium and Colletotrichum.

Bryophytes: Riccia, Marchantia, Porella, Anthoceros, Polytrichum & Fuaria.

Pteridophytes: Rhynia, Psilotum, Lycopodium, & Selaginella, Equisetum, Marsilea, Angiopteris & Polypodium.

Lichen: Morphological structures of different types of lichens.

Mycorrhiza: Morphological structures of different types of mycorrhiza. Spotters for Identification

Course Code	Course Title	Hours per week L-T-P	Credit C
MBY202C115	Lab-II	0-0-8	4

Objectives:

To find out the cell structure and cell organelles and Molecular Biology Techniques.
This course is planned to give hands on training on genetic engineering tools

PLANT TISSUE CULTURE & GENETIC ENGINEERING

1. Introduction to the laboratory and general safety practices for plant cell, plant growth and development. Laboratory Report Guidelines (Theory & Demo).
2. Aseptic culture techniques for establishment and maintenance of cultures (Hands on).
3. Tissue culture media preparation
4. Organ development from cultured tissue
5. Induction and maintenance of callus
6. Synthetic seed production
7. Induction of somatic embryos
8. Transformation of foreign genes into plant cells: use of *Agrobacterium tumefaciens* (Theory).
9. Gene transfer techniques (Theory)
10. Isolation of plasmids
11. DNA Isolation
12. Restriction digestion
13. Blotting techniques

CELL & MOLECULAR BIOLOGY

1. Prokaryotic & eukaryotic cell - structure observation.
2. Osmosis
3. Cell Division - Cytological preparations of tissues (onion) for mitosis.
4. Cell Division - Cytological preparations of tissues (*Tradescantia*) for meiosis.
5. Temporary and permanent slide preparation.
6. Isolation of Plasmid DNA (Ti Plasmid) from *E.coli* cells
7. Agarose gel electrophoresis for separation of DNA.
8. Isolation of plant DNA from leaf tissue.
9. Isolation of RNA from leaf tissue.
10. Isolation of total proteins from seed sample
11. Agarose gel electrophoresis for separation of DNA.
12. Restriction digestion.
13. Separation of plant pigments by chromatography
14. Spotters for Identification

BIOFERTILIZER & MUSHROOM CULTIVATION

BIOFERTILIZERS

- Isolation, identification of *Rhizobium*, VAM, *Azospirillum*

MUSHROOM CULTIVATION

- Preparation of culture, Spawn production, Cultivation Techniques.

Course Code	Course Title	Hours per week L-T-P	Credit C
MBY2021E11	Cell & Molecular Biology	3-0-0	3

Objectives:

- To acquire knowledge on Structure, organization, function, interrelationships of cell membrane and cell organelles and cell communication systems.
- To study on different types of cell transport system, language transcription and translation.

Cell

6 lectures

Unit 1: Prokaryotic and Eukaryotic cell, ultra-structure of plant cell, structural organization and functions of intracellular organelles - cell wall, nucleus, mitochondria, golgi body, lysosome, endoplasmic reticulum, ribosome, peroxisome, plasmid, vacuole, chloroplast, structure & function of cytoskeleton and its role in motility.

10 lectures

Unit 2: Structure of cell membrane, membrane transport, cell signalling, receptors, signal transduction; Cell division- mitosis and meiosis, difference between mitosis and meiosis, importance of cell division.

Molecular Biology

10 lectures

Unit 3: Structure and different forms of DNA, prokaryotic gene-regulatory structure of DNA (Promoter, Enhancer, Attenuator and terminator), structure of Eukaryotic gene (introns and exons), satellite DNA, Mechanism of DNA replication and DNA damage.

20 lectures

Unit 4: Transcription – definition, initiation, elongation and termination in prokaryotes, Differences in transcription between prokaryotes and eukaryotes; Transcriptional regulation – (trp, lac operon etc).

Transcription in eukaryotes –promoters, pribnow box, TATA box; Post transcriptional modifications in prokaryotes and eukaryotes - capping- polyadenylation. RNA splicing, SnRNPs, Spliceosome machinery, exon shuffling, RNA editing.

14 lectures

Unit 5: Genetic code –types of codons, tRNA structure, codon and anticodon interaction (wobble hypothesis) Translation – Initiation, elongation and termination in prokaryotes. Differences in translation between prokaryotes and eukaryotes -Post translational modifications. Protein signalling. Protein folding. Reverse transcriptase, cDNA synthesis and antisense RNA technique.

Textbooks/Reference books:

1. Pragma Khanna; 2008; Cell and Molecular Biology; I.K. International Publications New Delhi. Inbasekar.2013. Cell Biology and Genetics. Panima Book Distributors, Bangalore.
2. Allison.A. 2007. Fundamental Molecular Biology. Blackwell Publishing, UK.
3. Sambamurty A.V.S.S.; 2008; Molecular Biology; Narosa Publishers- New Delhi
4. De Robertis and De Robertis, 2014. Cell and Molecular Biology. Lippincott. Williams and Wilkins. USA.

5. Ajay Paul (2007). Text book of Cell and Molecular biology. Books and Allied (P) Ltd., Kolkata.
6. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter (2002). Molecular biology of the cell (IV Edn). Garland Science, Taylor and Francis group, New York.
7. Gerald Karp (2008). Cell and Molecular biology: Concepts and experiments (V Edn). John Wiley & Sons, India.
8. Du Praw, E. J. (1969). Cell and Molecular Biology. Academic Press, New York.
9. Leadbetter, M. C. (1970). Introduction to the Fine Structure of Plant Cells. Springer Verlag.23.
10. Levin, B. (1974). Gene Expression. Vol. I. Bacterial Genomes. Vol. II. Eucaryotic Chromosomes. Wiley Interscience. London.
11. Rastogi, S. C., Sharma, V. N. and Anuradha Tandon, V. N. (1993). Concepts in Molecular Biology. Wiley Eastern Ltd., New Delhi.
12. Verma, P. S. and Agarwal, V. K. (1998). Concept of Molecular Biology. S. Chand and Co. Ltd., New Delhi.
13. Primrose, S. B. and Twyman, R. M. (2006). Principles of Gene Manipulation and Genomics. 7th ed. Blackwell Science, London.
14. Karp, G. (2005). Cell and Molecular Biology – Concepts and experiments (4th ed). John Wiley and Sons, New York.
15. David Freifelder (2000). Molecular Biology (2 nd ed). Narosa Publishing House, New Delhi.
16. De Robertis, E. D. P. and De Robertis, E. M. F. (1980). Cell and Molecular Biology (7th Ed). Saunders College Publishers, Philadelphia.

Course Code	Course Title	Hours per week L-T-P	Credit C
MBY2021E12	Biofertilizers & Mushroom Cultivation	3-0-0	3

Objectives:

- To understand the structure, biology, nutrition and reproduction of bacteria used as bio fertilizers.
- To give information on pathogen causing diseases in plants and then cultivation process and uses of edible and non-edible mushrooms.

Biofertilizers

12 lectures

Unit 1: Biofertilizers- Introduction, scope and application, types of biofertilizers, Cyanobacterial biofertilizers –anabaena and azolla, medium, isolation (nitrogen fixing), mass cultivation, career material, field inoculation, organic farming and waste recycle.

12 lectures

Unit 2: Bacterial Biofertilizers - Yeast Extract Mannitol Agar medium, Culture characteristics. Mass production of Rhizobium, Azospirillum, Azotobacter, Phosphobacteria and Frankia, fermenter used for biofertilizer.

12 lectures

Unit 3: Mycorrhiza- Scope and general account of Ecto, Endo and Arbuscular Mycorrhizae (AM), isolation and inoculation techniques, Legume-AM interaction – National and Regional Biofertilizers production and Development Centres. Methods of collection, wet sieving, and decanting method and inoculums production, compost manuring.

Mushroom Cultivation

14 lectures

Unit 4: Mushroom Cultivation: Introduction and Scope of mushroom cultivation, types of edible and poisonous mushrooms in India, Identification of edible and poisonous mushroom food value of mushrooms, Medicinal value of mushrooms, Formation and Development of Basidiocarp – Agaricus, Importance and nutritive value of edible mushrooms, Isolation and culture of spores, culture media preparation, Production of mother spawn, Multiplication of spawn, harvest and storage methods.

10 lectures

Unit 5: Cultivation of Button mushroom (*Agaricus bisporus*), Milky mushroom (*Calocybe indica*), Oyster mushroom (*Pleurotus sajor-caju*) and Paddy straw mushroom (*Volvariella volvacea*). Food Preparation – Soup, cutlet, vegetable curry, samosa, omlette and pickle. Mushroom Research Centres in India.

Textbooks/Reference books:

1. Alice, D., Muthusamy and Yesuraja, M. (1999). Mushroom Culture. Agricultural College, Research Institute Publications, Madurai.
2. Dubey, R.C. (2008). A Textbook of Biotechnology. S. Chand & Co. Ltd., New Delhi.
3. Marimuthu, T. et al. (1991). Oyster Mushroom, Development of Plant Pathology. Tamil Nadu Agricultural University, Coimbatore.

4. Newton, W.E. et al. (1977). Recent Developments in Nitrogen Fixation. Academic Press, New York.
5. Nita Bhal (2000). Handbook on Mushrooms Vols. I & II (2nd ed.). Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
5. Pathak, V.N. and Yadav, N. (1988). Mushroom Production and Processing Technology. Agrobios, Jodhpur.
6. Schwintzer, C.R. and Tjepkema, J.D. (1990). The Biology of Frankia and Actinorhizal Plants. Academic Press Inc., San Diego, USA.
7. Subba Rao, N.S. (1982). Advances in Agricultural Microbiology. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
8. Subba Rao, N.S. (2002). Soil Microbiology (4th ed.) Soil Microorganisms and Plant Growth. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
9. Tewari Pankaj Kapoor, S.C. (1988). Mushroom Cultivation. Mittal Publications, New Delhi.
10. Tripathi, D.P. (2005). Mushroom Cultivation. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
11. Verma, A. (1999). Mycorrhiza. Springer Verlag, Berlin.
12. Kappor, JN. (1999) Mushroom Cultivation. ICAR. NewDelhi.
