



ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

Guwahati

Course Structure and Syllabus

(From Academic Session 2020-21 onwards)

M.Sc. Botany (CBCS)

3rd Semester



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Sl. No.	Sub-Code	Subject	Hours per Week			Credit	Marks	
			L	T	P		C	CE
Theory								
Core								
1	MBY202C301	Ecology, Energy, Environment & Bioinformatics	4	0	0	4	30	70
2	MBY202C302	Morphology, Taxonomy of Angiosperms & Economic Botany	4	0	0	4	30	70
3	MBY202C303	Plant Biotechnology	4	0	0	4	30	70
4	MBY202C304	Microbiology & Plant Pathology	4	0	0	4	30	70
Practical								
1	MBY202C315	Lab-V	0	0	8	4	30	70
2	MBY202C316	Lab-VI	0	0	8	4	30	70
Total			16	0	16	24	180	420
Total Contact Hours per week: 32								
Total Credits: 24								

Detailed Syllabus:

Course Code	Course Title	Hours per week L-T-P	Credit C
MBY202C301	Ecology, Energy, Environment & Bioinformatics	4-0-0	4

Objectives:

- To understand the sustainability of living system in different ecosystem
- To study different types renewable energy sources for environmental management
- To understand basic knowledge about the bioinformatics

ECOLOGY

8 Lectures

UNIT 1: History and Scope of Ecology. Concept of Ecosystem, its structure and function, Ecological factors; Biotic and Abiotic factors, Food chains, Food webs, and energy flow, Ecological pyramids, types of ecosystem - aquatic ecosystem (fresh and marine water ecosystem) and terrestrial ecosystems (forests, grasslands, savanna, alpine ecosystem, tundra and deserts)

12 Lectures

UNIT 2: Types of interactions: Negative interactions (predation, parasitism and antibiosis), positive interactions (commensalism, cooperation and mutualism), Plant community - qualitative analysis (transect, quadrat, plotless or point methods), Climatic factors – light, temperature, water, soil, atmosphere; Liebig's law of Minimum, Shelford's Law of tolerance. Plant succession – hydrosere and xerosere, biogeochemical cycle - C, N, P, S and water cycles, concept of climax.

ENERGY

16 Lectures

UNIT 3: Energy- definition, types – out line for renewable (wind, solar, hydrogen, biofuel) and non-renewable (coal, natural gas, petroleum) energy sources, **Biodiesel-** Definitions, History, current status of biodiesel, advantages and disadvantages of biodiesel, sources of biodiesel, oil extraction for biodiesel (mechanical and chemical methods) catalyst for biodiesel production, Methods of biodiesel production – pyrolysis, micro emulsification, transesterification (Acid and Base), purification, factors affecting biodiesel production, fuel properties of biodiesel (Density, Viscosity, Cetane number, Calorific value, flash and fire point), major biodiesel research institute in India and abroad, **Bio-ethanol-** Sources, production.

ENVIRONMENT

12 Lectures

UNIT 4: Pollution: Sources, nature and impact of different kinds of pollution (air, water, soil, thermal, radioactive and noise pollution), Global environment – Acid Rain, greenhouse effect and global warming and ozone layer depletion, Biodegradation of environmental pollutants

(pesticide waste, toxic heavy metals and petroleum products). Treatment of waste water (aerobic and anaerobic), water recycling, afforestation, Soil reclamation, phytoremediation.

BIOINFORMATICS

12 Lectures

Bioinformatics: Use of Computers in Biological research; Retrieval of sequence and structural information from internet; Genomics – definition, genome, functional genomics; Metabolomics – definition, types of metabolites, metabolome and NMR profile. Basic DNA sequencing – chain terminator sequencing, automated sequencing – analysis of sequence data.

Textbooks/Reference Books:

1. Billings, W.B. 1965. Plants and the ecosystem, Wardsworth Publ. Co., Inc., Belmont.
2. Conard, H.S. 1951. The background of Plant Ecology, Iowa state press, Iowa.
3. Kumar, H.D. 1986. Modern Concepts of Ecology, Vikas Publishing House, New Delhi.
4. Misra, R. 1968. The Ecology work book, Oxford & IBH Publishing & Co., Calcutta.
5. Odum, E.P. 1971. Fundamentals of ecology, W.B. Saunders & Co., Philadelphia, USA.
6. Shukla, R. S. and Chandel, P. S. 2015. Textbook of Plant Ecology. S. Chand Publications Pvt. Ltd., NewDelhi
7. M.Mathiyazhagan, 2011, Assessment of fuel efficiency of biodiesel from non-edible oils and waste oil, Ph.D. thesis, Bharathidasan University, Tiruchirappalli, Tamilnadu.
8. M.Mathiyazhagan and A.Ganapathi, 2011, factors affecting biodiesel production, research in plant biology (journal) 1(2), 01-05.
9. M.Mathiyazhagan and A.Ganapathi et all, 2011, production of biodiesel from non-edible plant oil having high FFA content, international journal of chemical and environmental engineering, 2(2), 119-122.
10. Rafael luque, juan Campelo and james Clark, Hand book of biofuels production, Woodhead publishing series in india,
11. Greg Pahl, Bill McKibben, 2008, Biodiesel: Growing a New Energy Economy, 2nd Edition / Edition 2, Chelsea Green Publishing.
12. Arthur M Lesk. 2003. Introduction to Bioinformatics, Oxford, UK.
13. David W Mount. 2002. Bioinformatics; Sequence and Genome Analysis. CSHL Press, Newyork.
14. Attwood TK and Parry-Smith DJ (2004) Introduction to Bioinformatics, Pearson Education (Singapore) Pvt. Ltd.
15. David Edwards (Ed.) (2007) Plant Bioinformatics: Methods and Protocols, Humana Press, New Jersey, USA.
16. Anathakrishnan, T.N. (1982)-Bioresource Ecology-Oxford & IBH Publ.Co.,Inc.,Belmont.
17. Ambasht, R.S. (1974) - A text book of plant ecology (3rd Edn.) Students' Friends. & Co., Varanasi, India.
18. Agarwal, K.C. (1987) - Environmental biology- Agro-botanical publications, India.
19. Chawla, S. 2011. A text book of Environment & Ecology. Tata Mc Graw-Hill, New Delhi.

20. Chapman, J.L. & Reiss, M.J. (2003). Ecology: Principles and Applications. Cambridge University Press, London
21. Sharma, P.D. (2017). Ecology and Environment. Rastogi Publications, Meerut
22. Siddhartha, K. (2013). Ecology and Environment. Kisalaya Publications, New Delhi
23. Verma, V. (2011). Plant Ecology. Ane Books Pvt. Ltd., New Delhi.
24. Ambast, R.S. & Ambast, N.K. (2008). A Text Book of Plant Ecology. CBS Publishers, Ltd, N. Delhi.
25. Kumaresan, V. & Arumugam, N. (2016). Plant Ecology and Phytogeography. Saras Publications, Kanyakumari.
26. Kapur, P. & Govil, S.R. (2004). Experimental Plant Ecology. CBS Publishers Pvt Ltd., New Delhi.

Course Code	Course Title	Hours per week L-T-P	Credit C
MBY202C302	Morphology, Taxonomy of Angiosperms & Economic Botany	4-0-0	4

Objectives:

- To understand the morphological characters of flowering plants in the plant kingdom.
- To acquire the knowledge of taxonomy of important angiospermic plants.
- To study about the economic importance of flowering plants

Morphology of Angiosperms

6 Lectures

UNIT 1: Vegetative and reproductive parts of angiospermic plant, detailed study of modifications and functions of root, stem and leaves with special reference to insectivorous plants, study of bracts and bracteoles.

12 Lectures

Inflorescence and flower: types of inflorescence, parts and functions of flower, forms of calyx and corolla, types of aestivation, detailed study of androecium – parts, union of stamen, attachment of anther, dehiscence of anther, detailed study of gynoecium – parts, types, ovary, placentation, types of ovule, floral formula and floral diagram.

12 Lectures

UNIT 2: Microsporogenesis and megasporogenesis, pollination (types and agents) pollination mechanism in Salvia, Calotropis, Ficus, Orchid, Vallisneria, fertilization – pre and post fertilization, polyembryony, types of fruit and seed dispersal mechanism.

Taxonomy of Angiosperms

8 Lectures

UNIT 3: Construction of taxonomic keys --indented and bracketed, A detailed study of the following families with their economic importance: Annonaceae, Capparidaceae, Rutaceae, Fabaceae, Cucurbitaceae, Meliaceae, Rhamnaceae, Lythraceae, Combretaceae.

12 Lectures

UNIT 4: A detailed study of the following families with their economic importance: Rubiaceae, Asteraceae, Asclepiadaceae, Solanaceae, Lamiaceae, Nyctaginaceae, Amaranthaceae, Euphorbiaceae, Zingiberaceae, Amaryllidaceae, Cyperaceae, Poaceae.

Economic Botany

10 Lectures

UNIT 5: Economic importance of Cereals: Wheat, Rice, Maize, Sorghum, Barley. Legumes: Black gram, Red gram, Chick pea, Pigeon pea. Fruits: Banana, Citrus, Mango. Spices and Condiments: Ginger, Pepper, Cardamom, Clove. Beverages from plants: Tea, Coffee and Cocoa. Fibres- Cotton, Jute, Sun hemp. Timber: Teak, Rosewood, Ebony, Sal and Mahogany. Vegetable Oil: Sun flower, Peanut, Palm Oil, Coconut and Sesame. Plants used as avenue trees for shade, pollution control and aesthetics.

Textbooks/Reference Books:

1. Taxonomy of Angiosperms. BP Pandey
2. Systematic Botany – RK Gupta

3. Taxonomy of Angiosperms – V. Singh & DK Jain
4. Plant Taxonomy – OP Sharma
5. Subramanyam, N. S. (1995). Modern Plant Taxonomy. Vikas Publishing House Pvt. Ltd., New Delhi.
6. Pandey S.N. and Mishra. S.P. 2009. Taxonomy of Angiosperms. Ane Books Pvt. Ltd. New Delhi.
7. Pandey, B.P. 2012. Taxonomy of Angiosperms. S.Chand and Company Ltd., New Delhi.
8. Porter.C.L., 1982 – Taxonomy of Flowering Plants, Eurasia Publications House, New Delhi
9. Pandey.B.P. (1987) – Economic Botany.
10. Verma. V (1984) – Economic Botany.
11. Benson, L. D. (1962). Plant Taxonomy: Methods and Principles. Ronald Press, New York.
12. Bilgrami, K. S. and Dogra, J. V. (1990). Phytochemistry and Plant Taxonomy. CBS Publishers, New Delhi.
13. Chopra, G. L. (1974). Angiosperms. Jowhar Offset Press, Delhi, India. Cronquist, A. (1981). An Integrated System of Classification of Flowering Plants. Columbia University Press, New York.
14. Davis, P. H. and Heywood, V. M. (1963). Principles of Angiosperm Taxonomy. Oliver & Boyd,
15. Edinburgh. Erdtman, G. (1986). Pollen Morphology and Plant Taxonomy : Angiosperms An Introduction to Palynology. E.J.Brill, Leiden, Netherlands
16. Naik, V. K. (1984). Taxonomy of Angiosperms. Tata McGraw-Hill publishing Co. Ltd., New Delhi.
17. Pandey, B. P. (1995). Angiosperms. S. Chand & Co. Ltd., New Delhi.

Course Code	Course Title	Hours per week L-T-P	Credit C
MBY202C303	Plant Biotechnology	4-0-0	4

Objectives:

- To know basics of biotechnology and its applications in plant system
- To understand the different techniques, products derived from plants using modern biotechnology

12 Lectures

UNIT 1: Biotechnology – scope, history, importance, traditional and modern biotechnology, human genome project, gene bank, totipotency, Callus culture, applications tissue culture, Cryopreservation- methods, selection of material, cryoprotectors, freezing (slow, step wise and rapid), storage in liquid nitrogen, thawing, washing, reculturing, and future aspects.

12 Lectures

UNIT 2: Chromatography – paper, Colum and ion exchange, electrophoresis – Agarose gel and SDS-PAGE, PCR-working mechanism and applications, Bioreactors – types and applications

12 Lectures

UNIT 3: Enzyme immobilization – definition, methods (adsorption, entrapping, cross linking and encapsulation), advantages of enzyme immobilization, applications of enzyme, Biosensors types and applications, biotransformation, secondary metabolite enhancement through tissue culture technique.

12 Lectures

UNIT 4: Production of organic acid, enzymes and vitamins, biofuel (ethanol production), bioplastics, biochips, bioterrorism, mush room - cultivation of paddy straw mush room, clonal propagation- Technique, factors, limitation and its significance, production of single cell protein (Spirulina), biogas production – feed stock, methods, benefits.

12 lectures

UNIT 5: Gene therapy – definitions and types of gene therapy, methods of gene therapy (physical and chemical), success of gene therapy, future needs of gene therapy in India, Nod genes, Nif genes, Hup genes, Nodulin genes, edible vaccine, transgenic crops – cotton and brinjal, issues on genetically modified crops.

Textbooks/Reference Books:

1. Biotechnology. A Textbook of Industrial Microbiology by W. Crueger and a. Crueger, Sinauer Associates.
2. Principles of Fermentation Technology by P.F. Stanbury and A. Whitaker, Pergamon Press
3. Tkaez, J.S. and Lange, L. 2004. Advances in Fungal Biotechnology for Industry, Agriculture and Medicine. Academic/ Plenum Publications, New York.
4. Arora, D.K. 2004. Hand book of Fungal Biotechnology. Marcel dekker Inc., USA.
5. Wainwright. 1992. An introduction to fungal biotechnology. John Wiley & Sons, New York.
6. P.K. Gupta: Elements of Biotechnology, Restogi Publications, Meerut
7. Kalyan Kumar De: Plant Tissue culture, New central Book Agency, Calcutta
8. M.D. Kumar: A text book on Biotechnology, East west press, New Delhi
9. S.S. Purohit: Agricultural Biotechnology, Agrobios Publications, Joshpur
- 10.S. Ignacimuthu: Plant Biotechnology, Oxford & IBM Publishing Co., New Delhi
11. R.C. Dubey. 2015. A text book of Biotechnology, S.Chand & Co., New Delhi

Course Code	Course Title	Hours per week L-T-P	Credit C
MBY202C304	Microbiology & Plant Pathology	4-0-0	4

Objectives:

- This course will introduce the student to the world of microbes (bacteria, virus and fungi), which are there in every possible place.
- The principles of Plant Pathology also included to know different types of plant disease symptoms and its control measure.

12 Lectures

UNIT 1: Scope, history and branches of microbiology. Bacteria – morphology and fine structure, Classification of bacteria according to Bergey 's manual (9th ed.), bacterial photosynthesis, bacterial respiration, bacterial reproduction, conjugation, transformation.

12 Lectures

UNIT 2: Sterilization - Dry heat and moist heat (flaming, hot air oven, boiling and autoclaving), Laminar Air flow, kinds of media and preparation techniques. Nutrient agar, nutrient broth, Isolation of microorganisms from soil –serial dilution technique, Pure culture methods – pour plate, streak plate and spread plate methods. Culture maintenance and preservation. Microbial staining method – Gram staining.

12 Lectures

UNIT 3: Morphology of viruses – (size, shape and structure), classification of virus, replication of viruses (transduction, transfection, lytic and lysogenic cycles), transmission of virus – vector relationship. Isolation and purification of viruses. General account of mycoplasma and bacteriophages.

12 Lectures

UNIT 4: Symptoms, causative agents and dissemination of the following diseases in crop plants: Little leaf of Brinjal, Tobacco mosaic, Blight of Paddy, Leaf spot and wilt in cotton, Blast in Paddy, Citrus canker, Panama disease, Apple scab, Smut in maize, tikka (ground nut), red rot (sugar cane), early blight disease (potato), white rust (Crucifers).

12 Lectures

UNIT 5: Plant microbe interactions- types- legume root nodules, mycorrhizae and lichens, detailed study of defence mechanism of plants (physiological, biochemical and molecular aspects of defense mechanism, induced resistance), principles and methods of disease control-cultural practices, chemical measures and biological control, modern methods of crop protection by evolving transgenic plants (pest resistance and virus resistance).

Textbooks/Reference Books:

1. Microbiology. 2015. RC Dubey and DK Maheswari, S. Chand & Co., New Delhi.
2. Microbiology. 2015. PD Sharma, Rastogi Publications, Meerut
3. Microbiology. 1986. M.J. Pelczar, Jr., E.C.S. Chang and N.R. Krieg, McGraw Hill Company, New York.
4. Microbiology - concepts and applications. 1993. M.J. Pelczar, Jr., E.C.S. Chan and N.R. Krieg, McGraw Hill Company.
5. Microbiology. 1993. L.M. Prescott, J.P. Harley D.A. Klein – Wm.c. Brown publishers. Dutique, Jawa, Melbourne.

6. Modern Microbiology. 1962. Wayne w. Umbreit – W.H, Freeman and company, London.
7. Basic and Practical Microbiology. 1986. Ronald M. Atlas, Mac.Milleen Company, Newyork
8. Pandey, B. P. (1982). A Textbook of Plant Pathology, Pathogen and Plant Diseases. S. Chand and Co. Ltd., New Delhi.
9. Singh, R. S. (1990). Plant Diseases (6 th ed.). Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
10. Smith, K. M. (1957). A Textbook of Plant Virus Diseases. Little Borwn & Co., Boston.
11. Bilgrami, K. S. and Dube, H. C. (1990). A Textbook of Modern Plant Pathology. Vikas Publishing House Pvt. Ltd., New Delhi.
12. Butler, E. J. and Jones, S. G. (1949). Plant Pathology. Macmillan & Co., London.
13. Sambamurthy A.V. S.S. 2006. A Textbook of Plant Pathology. I.K. International Pvt.Ltd., New Delhi.
14. Sharma,O.P.2005. The Text book of Fungi. Tata McGraw Hill publishing company Ltd, New Delhi.
15. Sharma,P.D.2009. The Fungi. Rastogi publications, Meerut.

Course Code	Course Title	Hours per week L-T-P	Credit C
MBY202C315	Lab-V	0-0-8	4

ECOLOGY, ENERGY, ENVIRONMENT AND BIOINFORMATICS

1. Plant anatomy related to ecological adaptations.
2. To determine frequency /density/ abundance in a grassland vegetation.
3. Isolation of algae and bacteria from aquatic ecosystem
4. Estimation of soil moisture content
5. Estimation of TDS in water sample
6. Estimation of dust pollution on plants
7. Effects of industrial effluent in seed germination
8. Extraction of vegetable oils by Soxhlet apparatus
9. Biodiesel production from vegetable oils (Acid and Base method)

MORPHOLOGY AND TAXONOMY OF ANGIOSPERMS AND ECONOMIC BOTANY

1. Root types
2. Underground stems
3. Leaf shapes
4. Inflorescence types
5. Identification of Angiospermic plants of known family up to the level of genus and species with the help of keys (indented and bracketed)
6. Detailed study of vegetative and reproductive characters of angiospermic plants (one plant in each family) included in the syllabus.
7. Identification of family, genus, species and morphology of the useful parts of plants mentioned in the theory.

Note: - Compulsory excursion- Students have to collect and submit at least 50 plants properly pressed, mounted and arranged according to Bentham and Hooker's classification on Herbarium sheets.

Course Code	Course Title	Hours per week L-T-P	Credit C
MBY202C316	Lab-VI	0-0-8	4

PLANT BIOTECHNOLOGY

1. Preparation of MS (Murashige and Skoog) basal medium for tissue culture
2. To prepare medium for Anther culture *Datura innoxia* using IAA, MS medium
3. Restriction digestion and gel electrophoresis of plasmid DNA
4. Isolation of genomic DNA from *E. coli*.
5. Plasmid DNA isolation, quantification and agarose gel electrophoresis.
6. Restriction digestion, elution and cloning in *E. coli*.
7. PCR – technique with known primer
8. Preparation of protein extracts from *E. coli*, quantification and SDS-PAGE analysis
9. ELISA
10. Southern Hybridization
11. Separation of plant pigment Paper chromatography
12. Ethanol production – grapes
13. Preparation of media for tissue culture
14. Sterilization of explants
15. Induction and maintenance of callus – carrot
16. paddy straw mushroom production

MICROBIOLOGY AND PLANT PATHOLOGY

1. Working principle of autoclave, hot air oven and laminar air flow
2. Preparation of nutrient agar and nutrient broth
3. Isolation of soil microorganisms – serial dilution
4. Culture of microbes - pour plate, streak plate and spread plate methods
5. Microbial staining – gram staining
6. Collection and Identification of different types of plant diseases included in the syllabus
7. Isolation of phytopathogens (fungi and bacteria)
8. Hanging drop technique
