University of Science & Technology Meghalaya Department of BOTANY <u>MSC BOTANY</u> <u>POs , PSOs, COs</u>

SCHOOL OF BIOLOGICAL SCIENCE



M.Sc Programme Outcomes (PO):

PO1. Develop a conceptual understanding of principles and importance of Botany. Students would be benefited with knowledge of core subjects like plant diversity, physiology and biochemistry, molecular cytogenetic and application of statistics etc. which are offered in these subjects Modules on analytical techniques, plant tissue culture and photochemistry would make them obtain skills that help in doing research.

PO2. Learn about practical technique in lab for detail study of plant cell structure, reproduction, anatomy, breeding procedures for hybridization. Maintain a high level of scientific excellence in botanical research with specific emphasis on the role of plants. Create, select and apply appropriate techniques, resources and modern technology in multidisciplinary way. Practice of subject with knowledge to design experiments, analyze and interpret data to reach to an effective conclusion.

PO3. They would identify, formulate and analyze the complex problems with reaching a substantiated conclusion. Logical thinking with application of biological, physical and chemical sciences. Learning that develops analytical and integrative problem-solving approaches.

PO4. Students would perform functions that demand higher competence in national/international organizations with sporty and helping spirits. Prepare the students for many competitive exams like MPSC, UPSC NET SET GATE.

PO5. Best problem-solving skills in students would encourage them to carry out innovative research projects thereby making them to use knowledge creation in depth. Enable the students to be resourceful in identifying the plants

PO6. Knowledgeable, disciplined students with good values, ethics, and kind heart will help in nation building globally. Student should be aware of ethical issues and regulatory considerations while addressing society needs for growth with honesty.

PO7. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and development of the information to provide valid conclusions.

PO8. Design solutions from medicinal plants for health problems, disorders and disease of human beings and estimate the phytochemical content of plants which meet the specified needs to appropriate consideration for the public health.

PO9. Use of IT (word-processing, use of internet, statistical packages and databases). Communication of scientific ideas in writing and orally. Ability to work as part of a team. Ability to use library resources. Time management. Career planning.

PO10. Knowledgeable and disciplined students with good values and team work will help in nation building by providing Entrepreneurship and skill development

PO11. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO12. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

M.Sc Programme Specific Outcomes (PSO):

PSO1. Understand the nature and basic concepts of Cryptogams and Phanerogams

PSO2. To enable the students to identify the Angiosperms

PSO3. To get basic knowledge of molecular cell biology,plant physiology and biochemistry, cytology, genetics and plant breeding

PSO4. Understand the nature and basic concepts of plant pathology and microbiology, plant ecology, biophysical instrumentation, plant tissue culture palynology and developmental Botany

PSO5. Understand the nature and basic concepts of Biostatictics, computer application and bioinformatics

PSO6. To give practical knowledge to the students in different special papers by engaging them in various MSc research programmes to make them enable in the field of research.

Course Outcomes

Course code: MSB-101 Course title: Lower Cryptogams

Course outcome:

CO1. To give the students some basic idea about algal classification, habit, habitat, morphology, reproduction and evolution of algae.

CO2. Role of algae in soil fertility, algae in industry, algal indicators, blooms, Eutrophication. Biological importance of phytoplanktons and water blooms.Algal culture.

CO3. Understand about introduction, classification of fungus. Salient features of different classes of fungi.Economic importance of Fungi

CO4. Introduction, classification of Bacteria, Ultrastructure, Reproduction and nutrition of bacteria. Harmful and Beneficial effect of Bacteria.

CO5: General account of Virus, ultra structure, Classification, structure and reproduction of Virus. Viral genomes- its type and structure; Viroids, virusoids and Prions. Antiviral agents and interferons.

Course code: MSB-102

Course title: Higher cryptogams, Gymnosperms and Paleobotany Course outcome

CO1. To give the students some basic idea about the origin, evolution, classification of the group, its comparative morphological, anatomical and reproductive differences within the group and finally the application of Bryophytes.

CO2. Deals with the basic understandings of the origin and evolution of pteridophytes, its steller evolution and its types, telome concept, origin of seed habit in pteridophytes.

CO3. The students will have a understandings of classification of vascular cryptogams, morphological, anatomical and reproductive diversity of pteridophytes.

CO4. To give students some basic understandings of classification and salient features of major taxa of Gymnosperm, its characteristics, affinities and relationships among different taxa and finally the economic importance of Gymnosperms.

CO5. It was designed to give an understanding of geological time scale, fossilization process, classification and nomenclature of fossil plants, techniques in studying fossils.

Course code: MSB-103

Course title: Advanced Morphology, Anatomy and Taxonomy of Angiosperms

Course outcome

CO1. Studying plant morphology student will be benefitted to identify plants (visual identification) properly when they go for field work for collection of plants for different research works. Proper identification and classification is important in the fields like genetics, ecology, physiology, 4axonomy4i and evolutionary biology.

CO2. Taxonomy helps to organize plants into similar groups. So it becomes easier to study and place a new species whenever it is discovered during any research work. It also allows us to identify, group and properly name an organism through a standardized classification system.

CO3. As Taxonomy is the "Mother of plant science", it helps them to study all the applied disciplines of plant sciences such as Agriculture, Horticulture, Forestry, Pharmacognosy, Biotechnology, etc.

CO4. By studying plant tissues and cells (anatomy) they will learn how the plants constructed and how they work. These studies are very important because they lead to be a better understanding of how to take care for plants and fight plant diseases.

CO5. Plant morphology helps to know the different types and forms of leaves, flowers, fruits, seeds, etc., which is an identifying marker for closely related species.

<u>Course code: MSB-104</u> <u>Practical I</u> Course title: Lower Plant Diversity

Course outcome

CO1: To give the students some detail idea about algal classification, vegetative and reproductive structures of algae.

CO2: To give the students some detail idea about fungal and bacterial classification, vegetative and reproductive structures of fungi. Preparation and study of temporary and permanent slides of fungi and bacteria.

CO3: To give the students some detail idea about bryophytal classification. Preparation and study of temporary and permanent slides of vegetative and reproductive structures of various genera of bryophytes.

CO4: To give students some basic understandings of culture of algal cells and estimation of their growth

CO5: To give students practical understandings of various plant specimens under various genera according to the syllabus in the field study (local) by specimen collection, preservation and study in the field.

<u>Course code: MSB-105</u> <u>Practical II</u> <u>Course title: Lower Plant Diversity</u>

Course outcome

CO1: To give the students some detail idea about specimens of various genera of pteridophyte, gymnosperms by performing dissection, sectioning drawing, description and identification of the specimens

CO2: To give the students some detail idea about various angiospermic genera. Students learn about various monocot and dicot flora by performing dissection, sectioning drawing, description and identification of the specimens.

CO3: To give the students some practical knowledge about Morphoanatomical adaptive features of hydrophytes and xerophytes.

CO4: Preparation of permanent slides of various specimens of pteridophte, gymnosperms and angiosperms.

CO5: To give students practical understandings of various plant specimens under various genera according to the syllabus in the field study (local) by specimen collection, preservation and study in the field and preparation of field report.

Semester II

Course code: MSB-201 Course title: Molecular Cell Biology (FC)

Course outcome:

CO1. Molecular biology plays important role in understanding formations, actions, and regulations of various parts of cells which can be used to efficiently target new drugs, diagnosis disease, and understand the physiology of the cell.

CO2. This branch use large-scale, systems-level, and high-throughput datasets to derive new biological insights not easily obtained by other approaches

CO3. It is used to analyze and help solve murders and assaults in forensic medicine.

CO4. DNA-based technology offers a wide variety of new diagnostic approaches to infectious disease.

CO5. Recombinant DNA technology offers many different new approaches to the development of vaccines.

Course code: MSB-202 Course title: Biochemistry and Advanced Physiology

Course outcome:

CO1. To get detail Biochemical knowledge about carbohydrate, protein, lipids, vitamins and enzymes as well as uses of various vitamins as coenzymes

CO2. Understand the basic physiological relationship of Plant, water and soil and translocation of organic solutes Mechanism of stomatal transpiration.

CO3. Understand the basic biochemical and physiological knowledge about the utility of different minerals present in the soil for the growth and development of plants and the deficiency symptoms of micro and macro nutrients to plants

CO4. Understand the detail knowledge about the biochemistry and physiology of photosynthesis, c and respiration i.e., breakdown of sugar: Glycolysis, Kreb's cycle, electron transport chain, ATP formation, photorespiration, gluconeogenesis.

CO5. To gather the detail knowledge about Nitrogen metabolism and physiological role of phytohormones in the growth and development of plants

CO6. Understand detail knowledge about the physiology of flowering, scenescens and abscission in plants and dormancy of seed, Phytochrome, Biological rhythm.

Course code: MSB-203 Course title: Cytogenetics and Plant breeding

Course outcome:

CO1. To understand basic principles of Mendelian inheritance.

CO2. To study cell division & chromosome segregation

CO3. To explore the multifactorial inheritance.

CO4. To acquire the chromosome structure, chromatin organization and variation.

CO5. To learn the concepts of Linkage concept of sex determination and sex linked inheritance.

CO6. To gain knowledge about the organellar inheritance.

Course code: MSB-204 Practical III Course title: Biochemistry of Advanced Physiology

CO1. To get detail practical knowledge about Separation and identification of sugars and amino acids by paper chromatography.

CO2. To learn how to determine water potential of plant tissue

CO3. To learn how to determine RQ of different seeds.

CO4. To learn how to determine Chlorophyll- a, Chlorophyll- b and total Chlorophyll and carotenoid.

CO5. To learn how to estimate catalase and peroxidase enzyme content from plant tissue.

Course code: MSB-205

Practical IV Course title: Cytology, Cytogenetics, Molecular Biology and Plant Breeding

Course outcome:

1. CO1. To understand how to prepare of mitotic and meiotic spreads and analysis of various stages of cell division

(Allium and Rhoeo, Wheat/Rice).

CO2. To study how to isolate genomic DNA from plant materials, purification and estimation

CO3. To study induced and natural chromosomal aberrations.

CO4. To learn the method of protein estimation. How to construct linkage map from available data

CO5. To learn the floral morphology and flower structure and also to learn hybridization techniques.

Semester III

Course code: MSB-301 Course title: Plant Pathology and Microbiology

Course outcome:

CO1. Understanding introduction to plant pathology, classification of diseases, process of infection and pathogenesis.

CO2. To get knowledge about host parasitic infection, defense mechanism in plants.

CO3. To get knowledge about biotechnological approaches to disease resistance and major diseases in plants.

CO4. Understanding the introduction, scope of microbiology, use of microbiology I human welfare.

CO5. Understanding control of microorganism, microbial techniques.

CO6. To get knowledge about Immuno and immune systems.

Course code: MSB-302 Course title: Biophysical instrumentation, Biotechnology and Developmental Botany

Course outcome:

CO1. The branch biophysical instrumentation seeks to explain biological function in terms of the molecular structures and properties of specific molecule.

CO2. Molecular biophysics typically addresses biological questions similar to those in biochemistry and molecular biology, seeking to find the physical underpinnings of biomolecular phenomena.

CO3. These *instruments* and techniques even can view and manipulate single molecules and measure their behavior.

CO4. Plant tissue culture can be used to genetically modify crops to produce high quality crops.

CO5. Modern developmental biology studies the genetic control of cell growth, differentiation and morphogenesis, which is the process that gives rise to tissues, organs and anatomy.

Course code: MSB-303 Course title: Plant Ecology

Course outcome

CO1. Understanding the nature of ecosystem, food chain, food web, biosphere, biogeochemical cycles.

CO2. To get detail knowledge about population ecology

CO3. To get detail knowledge about concept of community, concept of climax, ecological succession.

CO4. Understanding the cause, effects of environmental pollution.

CO5. Detail knowledge about plant diversity, loss of diversity, indigenous medicinal system. Biosphere reserve, protected areas of India.

CO6. Strategies for conservation of plant diversity, seed bank, activities of BSI, sustainable development

Course code: MSB-304

<u>Practical V</u> <u>Course title: Microbiology, Plant Pathology, Biotechnology and</u> <u>Developmental Biology</u>

Course outcome:

CO1. To learn about preparation and sterilization of various microbial culture media and inoculation.

CO2. To get knowledge about how to identify various plant diseases, isolation and study of the pathogens and how to make disease herbarium sheet/ report.

CO3. To get knowledge about differential staining of bacteria using Gram stain.

CO4. Prepare a plant extract and perform TLC

CO5. Techiques to study pollen morphology and how to develop hydroponic cuture

CO6. To get knowledge about study of Microsporogenesis and Megasporogenesis

Course code: MSB-305 Practical VI Course title: Plant Ecology

- CO1. To learn about qualitative aspects of field ecology
- CO2. To learn about qualitative aspects of aquatic ecology
- CO3. To learn about quantitative aspects of field ecology
- CO4. To learn about quantitative aspects of aquatic ecology

CO5. Hand on training of various ecological instruments and visit to different research institute/University

Course code: MSB-306

DSE-I Course title: Bio fertilizer and organic farming

Course outcome:

CO1. To get the knowledge of different microorganism involve in improving soil health.

CO2. It will also give the knowledge of organic farming.

CO3. Students will learn different techniques to produce biofertilizer

CO4. Students will learn about the methods of isolation and inoculum production of VAM, and its influence on growth and yield of crop plants.

CO5. Students will get detail knowledge about organic farming, animal husbandry, homemade fertilizer.

Semester IV

Course code: MSB-401

Course title: Biostatistics, Computer application and Bioinformatics

Course outcome:

CO1. To understand the importance and scope of statistical methods in experiments.

CO2. To learn various statistical methods, formulas to analyze different experiments as well as principles of designs of experiments.

CO3. To get the basic knowledge of types and components of computer

CO4. To learn about computer application for preparation of manuscripts, drawings, graphs, charts histograms.

CO5. Understand bioinformatics, biological database, Sequence analysis and comparison

CO6. Learn about Digital computer, Needle man – Wuncle and Smith-Wateman algorithm.

Basic knowledge of drug design.

Course code: MSB-402 Course title: Special paper

***Any one of the following

- A. Genetics and plant breeding
- **B. Biochemistry and Plant Physiology**
- C. Angiosperm taxonomy
- D. Plant ecology
- E. Microbiology
- F. Mycology and Plant Pathology

Course code: MSB-402A Course title: Genetics and plant breeding

Course outcome:

CO1. To understand the gene expression and regulation in Prokaryotes & Eukaryotes.

CO2. To gain better knowledge in both Prokaryotes & Eukaryotes about the Gene Mutation, Repair Mechanisms, Nuclear Genome Organization, Genes and gene numbers.

CO3. Comprehensive and detailed analysis of fine structure of the gene.

CO4. Analyze the role of transposable elements in prokaryotes and eukaryotes.

CO5. Insight into the manipulation of genetic material for a wide variety of purposes and products via Recombinant DNA Technology.

Course code: MSB-402B Course title: Biochemistry and Plant Physiology

Course outcome:

CO1. Understand the basic knowledge about atoms, molecules and bonds, various stabilizing reactions. Structure and properties of pH, buffers

CO2. Detail knowledge about bioenergetics, laws of thermodynamics.

CO3. Detail knowledge about carbohydrate metabolism and lipid metabolism.

CO4. Understanding the enzyme biochemistry

CO5. To learn about the physiological effects of various biotic and abiotic stress. Responses of plants to biotic (pathogen and insects) and abiotic (water, drought, salinity, temperature and global warming) stresses.

Course Code: MSB-402C Course title: Angiosperm Taxonomy

Course outcome:

CO1. Understand the basic idea of flowering plants and their systematic position or classification.

CO2. Students may visit the forest area for collection of plants and identify with upto their knowledge learnt at the class

CO3. Students may know the uses of unknown plants used by the tribal people of the soeity with ethnobotanical uses.

CO4. Students may visit some research organsaions like BSI, NBRI, FRI and can gather knowledge about the herbarium technique with up to date nomenclature of the plant

CO5. They can apply for Research fellowship for Ph. D and other higher Degree in Plant Taxonomy in Universities and Deem Universities for their future employment.

Course code: MSB-402D Course title: Plant Ecology

Course outcome:

- CO1. Detail knowledge on the environment, its types, concept of habitat and niche.
- CO2. Detail knowledge on population ecology
- CO3. Detail knowledge on community ecology
- CO4. Detail knowledge on ecosystem ecology and ecological succession.
- CO5. Detail knowledge on mineral cycling

Course code: MSB-402E Course title: Microbiology

Course outcome:

CO1. Understanding microbial taxonomy and diversity, classification, microbial photosysthesis, chemosynthesis, microbial respiration

- CO2. Detail knowledge about soil, air and water microbiology
- CO3. Genetic recombination in bacteria.
- CO4. Detail knowledge on mutation in bacteria.
- CO5. Detail knowledge on recombinant DNA technology

Course code: MSB-402F Course title: Mycology and Plant Pathology

Course outcome:

CO1. Understand history of Mycology, Fungal cell structure and classification, phylogenetic relation. CO2. (0.2)Morphology and reproduction and diversity of spores of few important fugal genera.

CO3. Understanding fungal physiology, nutritional specialization, secondary metabolites in fungus, mycotoxins.

- CO4. To get knowledge about fungal ecology.
- CO5. To get knowledge about fungal biotechnology.

Course code: MSB-403A

Course title: Genetics and plant breeding Course outcome:

CO1. Genetics has always been concerned with the problem of how the hereditary information in DNA controls what an organism looks like and how it works.

CO2. Scientists and doctors hope to use our *genetic* information to diagnose, treat, prevent and cure many illnesses

CO3. A number of graduate students can be involved in responsible positions with academic & research institutions.

CO4. Plant breeding is one of our most important weapons in this race by which one can create disease resistant varieties through selection and modern breeding methods.

CO5. A trained graduate teacher in molecular, genetics and plant tissue culture can be involved in government and private companies that are associated with molecular to cultivar development work.

Course code: MSB-403B Course title: Biochemistry and Plant Physiology

Course outcome:

CO1. To get knowledge of water relation, ion uptake and transport mechanism of nutrient in plant.

CO2. To know the different mechanism of photosynthesis and respiration of plant.

CO3. To know about the plant growth regulator and nitrogen metabolism of plant.

CO4. To get the knowledge of physiology of flowering and growth and development mechanism of plant.

CO5. To get the knowledge of dormancy and germination of seed.

Course title: Angiosperm Taxonomy Course code: 403C

Course outcome:

CO1. Studying plant morphology student will be benefitted to identify plants (visual identification) properly when they go for field work for collection of plants for different research works. Proper identification and classification is important in the fields like genetics, ecology, physiology, systematics and evolutionary biology.

CO2. Taxonomy helps to organize plants into similar groups. So it becomes easier to study and place a new species whenever it is discovered during any research work. It

also allows us to identify, group and properly name an organism through a standardized classification system.

CO3. As Taxonomy is the "Mother of plant science", it helps them to study all the applied disciplines of plant sciences such as Agriculture, Horticulture, Forestry, Pharmacognosy, Biotechnology, etc.

CO4. By studying plant tissues and cells (anatomy) they will learn how the plants constructed and how they work. These studies are very important because they lead to be a better understanding of how to take care for plants and fight plant diseases.

CO5. Plant morphology helps to know the different types and forms of leaves, flowers, fruits, seeds, etc., which is an identifying marker for closely related species.

Course title: Plant Ecology Course code: 403D

Course outcome:

CO1. To highlight the students with some basic understandings of conservation ecologyits principles, postulates and ethics. The students will also get an idea of protected area networks and their management, Biodiversity act and biodiversity action plan. Finally students will also learn about some practical case studies on conservation/management strategy in India.

CO2. Designed to give an understanding of, what is a natural resource, types of resources, natural resources degradation and its conservation. The students will also have an understanding on shifting cultivation, coal mining and also the various environmental problems of northeast India and its ecological implication and also about sustainable development.

CO3. It has been designed to impart an understanding on global environmental problems such as ozone depletion, global warming, greenhouse effect, different greenhouse gases, acid rain, climate change and its ecological consequences

CO4. It deals with the understanding of some modern technology used in landscape monitoring and environmental management such as remote sensing and GIS - it's Principles and concept, understanding on image processing techniques and various application of remote sensing and GIS

CO5. Deals with the understanding of phyto-geographical regions of India,detail idea about the floras of North-East India. Understanding on mechanism of migration and barrier of plant distribution and also about biodiversity hotspots and endemism

Course code: MSB-403E Course title: Microbiology

Course outcome:

CO1. Understanding briefly about industrial microbiology

- CO2. Detail knowledge about microbial fermentation and industrial fermentation
- CO3. Uses of microbes in medicine, biofuel, biopolymer, alcoholic fermentation
- CO4. To get knowledge about microbiology in stress environments
- CO5. Basic knowledge about food microbiology
- CO6. Uses of microbe sin petroleum microbiology

Course Code: MSB-403F Course title: Mycology and Plant Pathology

Course outcome:

CO1. Understanding symptoms of plant diseases caused by fungi, bacteria, viruses, mycoplasmas and Phytoplasmas

- CO2. Diagnosis and identification of diseases, host pathogen interaction
- CO3. Detail knowledge on epidenmiology and disease management
- CO4. Genetics of plant diseases
- CO5. To get knowledge about Biotechnology and plant diseases.

Course code: MSB-404

Projects

Course outcome:

- Desertation for students in 6 identifies fields Genetics and plant breeding, Biochemistry and plant Physiology, Angiosperm Taxonomy, Plant ecology, Microbiology and Plant pathology and Mycology are carried on under the supervision of subject expert in different identified fields.
- Project work deals with literature review, understanding local issues and challenges and generating solution for the same.
- Students capacity as a researcher and preparing them for further research work is being supervised identifying his or her own area of interest.
- This also helps the students to explore a subject in depth, manage a research project, define a suitable question and to use the appropriate research tools.Seminars, study tours, collection of specimen, cultivating crops (on specialized area) regular filed visit,data collection, survey, laboratory analysis, data interpretation,learning research methodology, joining in workshops, presenting papers in seminars, application of Boistatistics and bioinformatics on their data, writing skills,visiting advance laboratories and industries etc are some of the tools applicable while doing the desertation.

- All the desetation works are supervied by subject experts and examined by subject eperts from other universities of the region.
- This course prepare the students for choosing research as next option after master degree and further strengthen them to apply for industrial and other sector jobs as well.

<u>Course code: MSB-405 (DSE-2)</u> <u>Course title: Plant resource utilization and conservation</u>

Course outcome:

CO1. By studying "Plant resource utilisation" students will learn about different dimensions of plant identification as a resource for self- sustenance, their domestication, commercialization based on the need and induction of modification using modern techniques.

CO2. They will learn about the utilization of wild plants as it is more limited and how to improve it for the new need and imperatives of mankind.

CO3. Study of medicinal plants would help them in research and development of newer organic drugs that would help to minimize adverse effect that are usually evident in synthetic and semi-synthetically processed drugs. Thereby proving to be a boon to medical science.

CO4. They will learn about the different conservation processes like in-situ and ex-situ conservation of plants that are going to be extinct very soon due to biotic, abiotic and anthropogenic causes.

CO5. Study of plant resource utilisation will enhance their specific knowledge and technological skills in converting the rich bio-resource into economic wealth.

Course code: MSB-406 <u>HVP 740</u> Course title: Human values and Professional ethics

Non credit mandatory course

CO1. To critically understand ethical issues as they pertain to professional and personal identity.

CO2. To learn to consider oneself and the world around from these basic ethical positions.

CO3. To develop sharpened analytic powers and capacities for oral and written expression.

