CMJ UNIVERSITY, SHILLONG

REGULATION FOR MPHIL BOTANY

Duration – One Year

Eligibility - M.Sc. with relevant subject or its equivalent

Sr. No	Subject	Internal Assessment Mark	Term End Examination	Total Marks	Passing Marks
1.	Elective 1	30	70	100	40
2.	Elective 2	30	70	100	40
3.	Elective 3	30	70	100	40
4.	Elective 4	30	70	100	40
5.	Project			400	

Available Electives:

Advanced cytogenetics

Microbiology and industrial biotechnology

Physiology of stress in plants

Plant cell, tissue and organ culture

Microbial genomics and bioinformatics

Nanobiotechnology

Phytochemistry

Course : Advanced Cytogenetics

1. Dynamics of cell division. Karyotype differentiation and evolution.

2. chromosomal aberrations (numerical and structural)

Translocation

Inversions

Duplication and deficiencies

Their role in chromosome mapping

3. Evolutionary role of polyploidy and it uses:

4. Aneuploids

Alien chromosomes, gene substitution and addition and their probable role in

crop improvement.

5. Cytogenetic nature of sex determination.

6. Structure and composition of chromatin & chromosomes including the details of

the structure of centromere and telomeres.

7. Techniques and mechanism of banding in chromosomes.

Course: Microbiology and Industrial Biotechnology

1. scope and application of microbes in :

(a) Agriculture with reference to biological nitrogen fixation.

(b) Food (sources of food and feed)

(c) Pollution (degradation of pesticides and hydrocarbons in soils.

2. Biococnversion of agricultural crop residues and garbage by microbes for the production of alcohol and biogas.

3. Medical microbiology: Laboratory diagnosis of important human diseases , antimicrobial drugs and their mechanism of action and drug resistance.

4. Immunobiology _preparation of antigens and antisera, characterization of antigen antibody reactions by immunodouble diffusion and general immunoelectrophoretic techniques and western blotting, characterization of antigenic sites by immunoelectron microscopy, strategies for the production of vaccienes and monoclonal antibodies.

5. Microbiology of phylloplane and its applications in biological control of airborne insect pests and fungal pathogens.

6. Microbiology of rhizosphere and its importance in controlling soil- borne plant pathogens.

7. General considerations of microbial strain improvement for agriculture, medicine and industry.

8. General considerations for biotransformation and production of useful compounds through cell culture, factors affecting yield; immobilized cell systems and bioreactors.

9. Industrial production of:

(a) Antibiotics

(b) Acetic acid

(c) Lactic acid

(d) Citric acid

(e) Common enzymes and

(f) Microbial insecticides

Course : Physiology of Stress in Plants

• Types of Stress- Abiotic (Including pollutants) and Biotic. Alterations in physiology of plants due to the enlisted stress and their mechanisms to combat:

• Stress due to prolonged sun light & UV, mechanism of resistance to UV eg. through induction of pigment synthesis, plant repair enzymes

• Stress due to chilling, mechanism of resistance

• Stress due to high temperature, mechanism of avoidance and reduction

• Stress due to water – Plants and water, chemical & water potential gradients, transpiration, stomatal apparatus, mechanism of opening & closing, antitranspirants, Effect of water stress on accumulation of proline and betaines and their possible role in osmotic adjustment under such conditions. Drought tolerance/resistance mechanism, Screening methods for water stress tolerant varieties.

• Availability of soil water & determination of soil water potential,Mechanism of plant resistance to water logging/ hypoxia.

• Stress due to salinity, mechanism of salt tolerance in higher plants

• Mechanism of plant resistance to nutrient deficiency stress

• Elementary idea of mechanism of plant resistance to aluminium and heavy metal toxicity

• Elementary idea of mechanism of resistance in plants against viruses, fungal pathogen and insects (including Bt technology).

Course : Plant Cell, Tissue and Organ Culture

- Techniques of organ, tissue, free cell and protoplast culture.
- Methods of preparation and sterilization of tissue and culture media.
- Aspects of nutrition of plant tissue and organ cultures.
- In vitro culture and application of the following:
- Apical meristem
- Flower, fruit
- Anther and pollen, pathways of androgenesis
- Ovary, ovule, nucellus and endosperm
- Embryo and its significance in breeding
- Protoplast culture, somatic hybridization and its application in crop improvement
- Totipotency of free angiosperm cell and the significance of free cell culture
- Growth, differentiation and organogenesis in plant tissue and organ culture
- Somaclones and induced variations
- Gene delivery systems and role of transgenes in crop improvement
- Industrial production of secondary metabolites from callus

Course : Microbial Genomics and Bioinformatics

1. General characters of microbial genomes, special features of gene organization in industrial filamentous fungi.

2. Prokaryotic vs. eukaryotic genome with special reference to classification, time scale, genome shape and size, gene content and organization, codon use and gene expression.

3. Molecular biology techniques for microbial genome sequencing, analysis of the transcriptome and proteome.

4. Biological databases- nucleotides, proteins, genomic, transcriptome, metabolism, mutation and mitochondrial databases.

5. Computational methods for the analysis of genome sequence, data-sequence pair wise alignment, database searching, multiple alignment, sequence assembly, gene prediction, protein sequence analysis.

6. Molecular evolution and molecular phylogeny, molecular clock.

7. Evolutionary and phylogenetic analysis, phylogenetic tree reconstruction methods.

8. Evolution of the fungi and their mitochondrial genomes.

9. Virogenomics: scope, second generation virogenomics, utility of microarrays in virogenomics.

10. Fungal pathogenicity genes; Genomics of pathogenic fungi: Blastomyces, Phytophthora, Fusaria; reverse vaccinology.

11. Genomics of Trichoderma, Aspergillus and Penicillium: variability, functional genomics of biocontrol strains

12. Genomics of Neurospora crassa and Magnaporthe grisea.

13. Genomics of arbuscular mycorrhizal fungi

Course: Nanobiotechnology

(1) Nanobiotechnology and bionanofabrication; biological effects and applications.

(2) Interaction of metal nanoparticles with microbes.

(3) Biosynthesis of metal and alloy nanoparticles using microbes.

(4) Bacterial spore engineering and applications in nanobiotechnology: delivery vechile, source of novel self-assembly proteins as biosensor.

(5) Biopolyster (Polyhydroxyalkanoates) nanoparticles: production by microbes and their applications.

(6) Cultivation of magnetotactic bacteria (MTBs); and biotechnological production and applications of magnetosomes.

(7) Alginate biosynthesis and modification by bacteria, alginate-based bionanostructures.

(8) Applications of bacteriophages: rDNA technology, phage display, protein evolution by phage display, bacteriophages as templates for inorganic nanostructures, nanowires and nanorings.

(9) Molecular biomimetics: combinatorial biology approach in selecting inorganicspecific peptides, post-selection engineering of inorganic binding peptides.

(10) Bacterial protein complexes: cellulosome and designer cellulosome, streptavidinbiotin.

(11) Bacterial protein complexes, S-layer proteins: potential applications in nanotechnology.

(12) Ethical, legal, social and environmental issues concerning nanoscience includeing possible health risks.

Course: Phytochemistry

• Basics of common phytochemical techniques: chromatography, chromatofocussing, spectrophotometry, spectrometry, electrophoresis, centrifugation and tracer techniques.

• General aspects of the structure, important properties, isolation, characterization and significance of the following groups of compounds:

• Carbohydrates

• Lipids

• Nucleic acids

• Ethylene hydrocarbons

• Indoles

• Cytokinins, purines, pyrimidines

• Gibberellins, isoprenoids

• Phenolics

• Flavonoids

• Porphyrins

• Alkaloids

• Proteins

• Basics of intermediary metabolism: Importance of Acetyl Co A and Shikimic acid