# S.N.M COLLEGE MALIANKARA

## DEPARTMENT OF Botany

**LESSON PLAN**

| Programme : M. Sc. Botany | | | | | |
|---|---|---|---|---|---|
| **Semester** | **Course code** | **Course title** | **Theory T** | **Practical P** | **Credit C** |
| **3** | BY010302 | BIOTECHNOLOGY, BIOINFORMATICS AND BIONANOTECHNOLOGY | 72 | 36 | 4 |
| **Teachers** | **Asha A** | | | | |
| **Academic Year** | **2022-23** | | | | |
| **Instructional Approach or method** | **FOCUSED INSTRUCTION---** LECTURES / DEMONSTRATION **GUIDED**<br>**LEARNING ----**ICT/ PRACTICE AND APPLICATION<br>**COLLABORATIVE LEARNING--** PROJECT/GROUP WORK<br>**INDEPENDENT LEARNING --**ASSIGNMENT & PRESENTATIONS | | | | |

| | **COURSE OUTCOMES (COs)** |
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| CO1: | **To transmit the knowledge of bioprocessing and micropropagation** |
| CO2: | **To introduce genome editing and other advance techniques in biotechnology** |
| CO3: | **To confer advancements in bioinformatics** |
| CO4: | **To provide an overview of nanotechnology and its applications** |
| CO5: | **Isolation, preparation, sterilization and inoculation of different explants.** |

| **MODULE AND HOUR** | **Learning Objectives** | **Lecture No.** | **Topics to be covered** | **Instructional Approach or method** | **Remarks** |
|---|---|---|---|---|---|
| BIOTECHNOLOGY<br>Module 1: Bioprocess Technology | Students get a idea about history of biotechnology<br>Get an indepth understanding about microbial | 1 | Introduction to classical and modern biotechnology. | Lecture | |
| | | 2 | Microbial biotechnology: Mode of operation of a bioprocess – basic concepts of batch, fed batch and | Lecture | |

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| | biotechnology and bioreactors | | continuous operation of a bioprocess. | | |
| | | 3 | Basic design and construction of various types of bioreactors used in bioprocesses. | Seminar & Discussion | |
| | | 4 | Commercial production of metabolites using bioreactors. Submerged and solid state fermentation. Microbes in production of enzymes, antibiotics, biopolymers. | Seminar & Discussion | |
| | | 5 | Commercial production of metabolites using bioreactors. Submerged and solid state fermentation. Microbes in production of bioethanol, organic acids, SCP. | Seminar & Discussion | |
| | | 6-9 | Production of amylase by solid state and submerged fermentation. | Practical | |
| Module 2: Plant tissue culture | Students will get knowledge about plant tissue culture<br>Students will be equipped to do all steps of plant tissue culture by themself | 10 | Brief history and important milestones in plant tissue culture. | Seminar & Discussion & Discussion | |
| | | 11 | Types of cultures: organized structures - meristem, shoot tip, node, embryo, root cultures; | Seminar & Discussion & Discussion | |
| | | 12 | Unorganized structures - callus, suspension and protoplast cultures. | Lecture | |
| | | 13 | Cellular totipotency. Differentiation of cells in callus - tracheid formation, chloroplast differentiation. | Lecture | |

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| | | 14 | Factors influencing vascular differentiation. | Lecture | |
| | | 15 | Organogenic and embryogenic differentiation | Lecture | |
| | | 16 | Culture protocol: general composition of the culture media; solid and liquid media – gelling agents. | Seminar & Discussion & Discussion | |
| | | 17 | Preparation and standardization of MS medium for shoot and root differentiation. Sterlization of medium, glasswares, instruments, plant material, transfer area. | Seminar & Discussion & Discussion | |
| | | 18-21 | Prepare the stock solutions MS medium and prepare MS medium from the stock solutions | Practical | |
| | | 22 | Preparation of explants and inoculation, incubation. Pattern of growth and development, subculturing | Seminar & Discussion & Discussion | |
| | | 23 | Isolation, preparation, sterilization and inoculation of different explants - shoot tip, . | Practical | |
| | | 24 | Isolation, preparation, sterilization and inoculation of different explants - node. | Practical | |
| | | 25 | Isolation, preparation, sterilization and inoculation of | Practical | |

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| | | | different explants -anther. | | |
| | | 26 | Isolation, preparation, sterilization and inoculation of different explants like shoot tip, node, anther, embryo and cambium. | Practical | |
| | | 27 | Micropropagation: methods – shoot tip and nodal segment culture, | Seminar & Discussion & Discussion | |
| | | 28 | Stages of micropropagation. Advantages and disadvantages of micropropagation. | Seminar & Discussion & Discussion | |
| | | 29 | Applications of tissue culture. | Seminar & Discussion & Discussion | |
| Module 3: Genetic engineering | Get an idea about genetic engineering, the processes involved and enzymes required<br>Will be able to understand the importance and scope of genetic engineering | 30 | Important steps in gene cloning: basic principles of gene cloning. | Lecture | |
| | | 31 | Isolation and purification of DNA from cells | Lecture | |
| | | 32-35 | DNA isolation from coconut/onion/cauliflower and separation using agarose gel | Practical | |
| | | 36 | Isolation of DNA fragments of interest, creation of recombinant DNA | Lecture | |
| | | 37 | Introduction into host cells, selection and screening of recombinants, propagation of recombinants. | Lecture | |
| | | 38 | Tools and techniques: Restriction endonucleases, Ligases. | Lecture | |

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| | | 39 | Vectors – necessary properties of a vector, types of vectors based on origin; | Lecture | |
| | | 40 | Types of vectors based on origin; | Lecture | |
| | | 41 | Shuttle vectors, expression vectors. | Lecture | |
| | | 42 | Plant transformation: Agrobacterium tumefaciens mediated gene transfer in plants - | Lecture | |
| | | 43 | details of vector system based on A. tumefaciens, binary vector and cointegrate vector. | Lecture | |
| | | 44 | Steps in Agrobacterium mediated gene transfer to plants. | Lecture | |
| | | 45 | Plant transformation by direct transfer of DNA (Vectorless methods) - microprojectiles, electroporation, microinjection, chemical, lipofection | Seminar & Discussion | |
| | | 46 | Applications of genetic engineering - in genetic studies, agriculture, medicine and environment | Seminar & Discussion | |
| | | 47 | Applications of genetic engineering - in agriculture | Seminar & Discussion | |
| | | 48 | Applications of genetic engineering - in medicine and environment. | Seminar & Discussion | |
| Module 4: Genome editing | Get insight into genome editing and its application | 49 | Introduction, | Lecture | |
| | | 50 | Scope & methods | Lecture | |
| | | 51 | Applications | Lecture | |

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| Module 5: Advanced tools and techniques in Biotechnology | Students will learn about various techniques involved in biotechnology. | 52 | cDNA synthesis, artificial DNA synthesis – solid-phase synthesis. | Lecture | |
| | | 53 | PCR - Procedure and applications, | Seminar & Discussion and discussion | |
| | | 54 | Variants of PCR - Real time PCR and reverse transcriptase PCR and their applications | Lecture | |
| | | 55 | Automated DNA sequencing | Lecture | |
| | | 56 | Site directed mutagenesis. | Lecture | |
| | | 57 | Blotting techniques - procedure and applications of southern, northern. | Seminar & Discussion and discussion | |
| | | 58 | Blotting techniques - procedure and applications western, and dot blotting | Lecture | |
| | | 59 | Microarray (gene chip) technology and its applications | Lecture | |
| | | 60 | Procedure and applications of DNA profiling, Footprinting | Lecture | |
| | | 61 | Procedure and applications of FISH and GISH | Lecture | |
| Module 6: Genomics | Get indepth knowledge about genomics and genome annotation | 62 | Introduction to genome, genomics, transcriptomics and proteomics. | Lecture | |
| | | 63 | Structural genomics - genome sequencing strategies. | Lecture | |
| | | 64 | Genome annotation – structural annotation | Lecture | |

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| | | 65 | Genome annotation – functional annotation | Lecture | |
| | | 66 | Gene expression study using microarrays. | Lecture | |
| Module 7: Societal concerns over biotechnology | Students will understand the negative aspects of using genetic enginerring | 67 | Potential impact of GMOs on the ecosystem; GM food – effect on health and environment. | Seminar & Discussion and discussion | |
| | | 68 | Misuse of modern molecular biology tools and techniques, bioweapons, bioterrorism. | Seminar & Discussion and discussion | |
| | | 69 | Ethical issues relating to rDNA techniques. | Seminar & Discussion and discussion | |
| | | 70 | Patents – issues relating to patenting living organisms, their genes and other bioresources. | Seminar & Discussion and discussion | |
| BIOINFORMATICS<br>Module 1: Methods, tools and applications of bioinformatics | Get knowledge about databases and sequence alignment<br>Students will be able to do blast search and find similarity between sequence of different species | 71-72 | Databases: Organization, primary and secondary databases. DNA sequence databases - Genbank, EMBL & DDBJ. | Seminar & Discussion and discussion | |
| | | 73 | Protein databases - SWISS-PROT, PDB | Seminar & Discussion and discussion | |
| | | 74 | Sequence alignment: significance; global alignment, pair wise analysis, scoring matrices (an introduction). | Lecture | |
| | | 75 | Database similarity search – query sequence search; BLAST – Algorithm and different versions. FASTA. | Lecture | |

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| | | 76 | Multiple sequence analysis, dynamic programming. | Lecture | |
| | | 77-80 | Blast search with Protein sequence (Magnolia latahensis sequence) | Practical | |
| | | 81-84 | Blast search with nucleic acid sequence (Neanderthal man's Paleo DNA) | Practical | |
| Module 2: Molecular phylogeny | Students will learn about phylogenetic tree<br>Student will be able to create phlogentic tree of different organism and will be able to identify the evolutionary relationship between different species. | 85 | Introduction, molecular clock hypothesis. | Lecture | |
| | | 86 | Phylogenetic trees, terminology in phylogenetic tree. Tree drawing methods. | Lecture | |
| | | 87 | Cladogram and Phylogram. Significance of molecular phylogeny. | Lecture | |
| | | 88-91 | Phylogenetic tree creation with the help of CLUSTAL X, W or MUSCLE and tree drawing tools. | Practical | |
| | | 92-95 | Creation of phylogentic trees for selected families of Eudicots | Practical | |
| Module 3: Structural bioinformatics | Students will be able to know how is unknown protein structure predicted. | 96 | Introduction, molecular structure viewing tool – Rasmol; | Lecture | |
| | | 97 | Protein structure prediction – secondary structure prediction (Chou Fasman method). | Lecture | |
| | | 98 | Protein structure prediction –tertiary structure prediction (Homology modeling). | Lecture | |

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| | | 99-102 | Molecular docking (using either free or commercial software) | Practical | |
| BIONANOTECHNOLOGY<br>Module 1: Introduction to nanoparticles and nanotechnology | Students learn about synthesis of nanoparticles using biological organisms | 103 | An overview on concepts, strategies and tools. Types of nanoparticles and their relative merits and demerits. | Lecture | |
| | | 104 | Method of biological synthesis of Zn nanoparticles – plant extract, bacteria and fungi. | Lecture | |
| | | 105 | Method of biological synthesis of Ag nanoparticles – plant extract, bacteria and fungi. | Lecture | |
| Module 2: Applications of bionanotechnology | Students will beaccomsted to application of bionanotechnology. | 106 | Use of nanoparticles in agriculture, medicine and environment. | Lecture | |
| | | 107 | Impact of NPs on germination and seedling emergence, parameters in various crops. | Lecture | |
| | | 108 | Effect of NPs on gene expression. Translocation and accumulation of NPs in plant tissues and organs. | Lecture | |

# S.N.M COLLEGE,MALIANKARA

## DEPARTMENT OF PHYSICS

LESSON PLAN

| Programme : M.Sc. Physics | | | | | |
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| **Semester** | **Course code** | **Course title** | **Theory T** | **Practical P** | **Credit C** |
| III | PH800301 | ELECTRODYNAMICS | 72 | 0 | 4 |
| **Teachers** | Dr. Lakshmi S Bose, Dr. Urmila K S | | | | |
| **Academic Year** | 2022-23 | | | | |
| **Instructional Approach or method** | **FOCUSED INSTRUCTION**— LECTURES<br>**LEARNING** —ICT ENABLED SESSIONS<br>**COLLABORATIVE LEARNING**– PROJECT/GROUP WORK<br>**INDEPENDENT LEARNING** –ASSIGNMENT, QUIZZ & SEMINARS | | | | |

## COURSE OUTCOMES (COs)

**CO1:** Impart proper understanding of electricity magnetism and electrodynamics

**CO2:** Explain the electromagnetic field radiating from accelerated charges and the impact of relativity in electromagnetism along with confined propagation of electromagnetic wave

**CO3:** Understand the wave nature of the electromagnetic field and its properties.

**CO4:** Use Maxwell equations in analyzing the electromagnetic field due to time varying charge and current distribution

**CO5:** Describe the nature of electromagnetic wave and its propagation through different media and interfaces

| MODULE AND HOUR | Learning Objectives | Lecture No. | Topics to be covered | Instructional Approach or method | Remarks |
|---|---|---|---|---|---|
| Electrostatics, Magnetostatics and basics of Electrodynamics(18 hrs) | Learn to integrate theoretical Concepts of electricity, magnetism & electrodynamics that exist in nature with a prominent role in the daily activities of human being | 1 | Introduction to Electrostatics, term electricity | Discussion as group | |
| | | 2 | Fundamental laws in electrostatistics | ICT enabled Lecture with examples | |
| | | 3 | Dielectric Polarization | Lecture & Demonstration | |
| | | 4 | Electric field in conductor, dielectric | Problems and illustration using Griffith | |
| | | 5 | Gauss law in dielectrics, | Video Lecture | |
| | | 6 | Boundary conditions in electrostatics, between different media | Lecture | |
| | | 7 | Uniqueness theorem And electrostatic potential | Video Lecture | |
| | | 8 | Poisson and Laplace equations | Video Lecture | |
| | | 9 | Laplace equations for boundary value problems | Group work and problems | |
| | | 10 | Method of images | ICT enabled classroom session | |
| | | 11 | Method of image point charge | Lecture | |
| | | 12 | Method of image line charge | Lecture | |
| | | 13 | Potential at a distance multipole expansion | ICT Video through Moodle | |
| | | 14 | Electric field of a dipole | Lecture | |
| | | 15 | Magnetism & Biosavats law | Group work | |
| | | 16 | Divergence & curl,Magnetic vector potential, multipole expansion | Video Lecture | |

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| | | 33 | Previous year essay questions | Class test | |
| | | 34 | Doubt clearing sessions | Group work | |
| | | 35 | Discussions with seminar topics | Group work | |
| | | 36 | Previous year question paper discussions | Group work | |
| Module III Electromagnetic radiation (18 hrs) | Learn to integrate the formulation of electrodynamics where one can able to solve the problems by using potentials in electrodynamics | 37 | Potential formulation of electrodynamics | Lecture | |
| | | 38 | Gauge transformations | Lecture | |
| | | 39 | Coulomb and Lorentz gauge | Comparative study using problems in electrodynamics | |
| | | 40 | Continuous charge distribution | Lecture | |
| | | 41 | Retarded potential | Video Lecture | |
| | | 42 | Retarded potential-problems | Group work | |
| | | 43 | Jefmenko's equation | Seminar Presentations | |
| | | 44 | Point charges | Lecture | |
| | | 45 | Lienard-Wiechert potentials | Video Lecture through Moodle | |
| | | 46 | Field of a point charge in motion | Lecture I | |
| | | 47 | Field of a point charge in motion | Lecture I continuation | |
| | | 48 | Power radiated by a point charge | ICT enabled classroom session | |
| | | 49 | Electric dipole radiation | Video Lecture | |
| | | 50 | Electric dipole radiation | Lecture continuation | |

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| | | 17 | Poynting theorem,Maxwell's stress tensor-momentum conservation. | Lectures | |
| | | 18 | Previous year question paper discussions and problem solving | Discussion and doubt clearing session | |
| | | 19 | Brainstorming session | | |
| | | 20 | **Internal Examination** | | |
| Electromagnetic waves (18 hrs) | Understanding of plane waves through which one can understand the propagation of electromagnetic waves in various media | 21 | Wave equation of E & H | Introductory lecture | |
| | | 22 | monochromatic plane waves- energy momentum | Seminar Presentation | |
| | | 23 | Propagation of em waves through linear media | Seminar Presentation | |
| | | 24 | Reflection and transmission of a plane wave at normal incidence | Lecture and work as a group for derivations | |
| | | 25 | Reflection and transmission of a plane wave at oblique incidence | Lecture | |
| | | 26 | Electromagnetic waves in a conducting medium | Seminar Presentation | |
| | | 27 | Reflection at conducting surface | Lecture with demonstration | |
| | | 28 | Reflection at conducting surface | Lecture with demonstration | |
| | | 29 | Dispersion of electromagnetic waves in non-conductors | Lecture with demonstration | |
| | | 30 | Dispersion of electromagnetic waves in conductors | Lecture with demonstration | |
| | | 31 | Dispersion of electromagnetic waves in plasma medium | Lecture with demonstration | |
| | | 32 | Problems | Group work | |

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| | | 51 | magnetic dipole radiation | Lecture continuation | |
| | | 52 | Radiation from arbitrary distribution of charges | Lecture | |
| | | 53 | Radiation from arbitrary distribution of charges | Video lecture | |
| | | 54 | Abraham Lorentz formula | Lecture continuation | |
| Relativistic electrodynamics and Waveguides (18 Hrs) | | 55 | Relativistic electrodynamics | Lecture | |
| | | 56 | Structure of spacetime | Lecture | |
| | | 57 | Four vectors | Video work and seminar | |
| | | 58 | Proper time and proper velocity | Lecture | |
| | | 59 | Relativistic energy and momentum | ICT enabled classroom session | |
| | | 60 | Relativistic dynamics- Minkowski force | Lecture | |
| | | 61 | Magnetism as a relativistic phenomenon | Assignment | |
| | | 62 | Lorentz transformation of em field | Lecture | |
| | | 63 | field tensor electrodynamics in tensor notation | Lecture | |
| | | 64 | Potential formulation of relativistic electrodynamics | Lecture | |
| | | 65 | Waveguides | Group work | |
| | | 66 | Waves between parallel planes- TE TM-TEM waves | Lecture | |
| | | 67 | Rectangular waveguide- TE-TM waves | Video lecture | |

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| | | 68 | Impossibility of TEM wave | Seminar presentations | |
| | | 69 | Cylindrical waveguide- TE-TM waves | Video Lecture | |
| | | 70 | Problems | Assignments | |
| | | 71 | Previous year question paper discussions | Group work | |
| | | 72 | Doubt clearing session | Group work | |

Lekshmi S Bose

Signature of Teacher(s) in charge

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