

Department of Botany

Semester : II

Name of the Course : Plant Diversity II -Pteridophyta, Gymnosperms and Palaeobotany

Subject code : PB1721

Teaching Plan

| Unit | Module | Topics | Lecture hours | Learning outcome | Pedagogy | Assessment/ Evaluation |
|---|--------|---|---------------|--|--|---|
| I. PTERIDOPHYTES – INTRODUCTION | | | | | | |
| | 1 | Origin and evolution of vascular plants; Stellar evolution | 4 | To know the basics of vascular plants | Lecture | Group discussions, Question – Answer sessions, Quiz, Formative Assessment I |
| | 2 | Telome theory; Apogamy and apospory | 4 | To understand about apogamy and apospory | Lecture, Charts | |
| | 3 | Economic importance of Pteridophytes. Classification of pteridophytes by G.M. Smith | 4 | To evaluate and categorize pteridophytes | Lecture, PPT | |
| II PTERIDOPHYTES – REPRODUCTION | | | | | | |
| | 1 | Range of thallus structure, reproduction and evolution of gametophytes and sporophytes of the following orders: <i>Psilotales</i> , <i>Lycopodiales</i> | 4 | To evaluate the detailed information about different orders of pteridophytes | Lecture, Microscopic slides, PPT | Short tests, Discussions, Microscopic observation |
| | 2 | <i>Selaginellales</i> , <i>Isoetales</i> , <i>Equisetales</i> . | 5 | To correlate the different orders of pteridophytes | Lecture, microscopic slides, live specimens, PPT | |
| III PTERIDOPHYTES – REPRODUCTION | | | | | | |
| | 1 | <i>Ophioglossales</i> , | 5 | To evaluate | Lecture, | Formative |

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| | | <i>Osmundales, Filicales and Salviniiales</i> | | the detailed information about different orders of pteridophytes | microscopic slides, live specimens, PPT | assessment, Microscopic observation, Formative Assessment II |
| | 2 | Sporangial development - Eusporangiate and Leptosporangiate types, heterospory and origin of seed habit and soral evolution | 4 | To understand the different forms of sporangia | Lecture, Illustrations | |
| IV GYMNOSPERMS | | | | | | |
| | 1 | Affinities and evolution of gymnosperms; Classification of gymnosperms (K.R. Sporne, 1965); | 4 | To evaluate and categorize Gymnosperms | Lecture, PPT | Microscopic observation, Short test, online quiz |
| | 2 | General characters - morphological, reproductive characters, phylogeny and interrelationship of the orders - <i>Cycadales, Ginkgoales</i> | 4 | To understand the general characters of different orders of Gymnosperms | Lecture, Illustration, Permanent slides | |
| | 3 | <i>Coniferales</i> and <i>Gnetales</i> . | 4 | To understand the general characters of different orders of Gymnosperms | Lecture, Illustration, Permanent slides | |
| V PALAEOBOTANY | | | | | | |
| | 1 | Geological time scale; Methods of fossilization and determination of the geological | 4 | To assess the different methods of fossilization | Lecture, Permanent slides | Microscopic observation, Question – Answer session, |

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| | | age of fossils, carbon dating | | | | Group discussions, Formative Assessment III |
| 2 | A brief study of the following fossil Pteridophytes: <i>Rhynia</i> , <i>Lepidodendron</i> | 4 | To know about the different fossil Pteridophytes | Lecture, Permanent slides | | |
| 3 | <i>Sphenophyllum</i> and <i>Calamites</i> . | 4 | To know about the different fossil Pteridophytes | Lecture, Permanent slides, PPT | | |
| 4 | A brief study of the following fossil Gymnosperms: <i>Lyginopteris</i> , <i>Cycadoidea</i> | 3 | about the different fossil Gymnosperms | Lecture, Permanent slides | | |
| 5 | <i>Pentaxylon</i> and <i>Cordaites</i> . | 3 | about the different fossil Gymnosperms | Lecture, Permanent slides, PPT | | |

Course Instructor: Ms. L. Dyona

HOD: Dr. C. Jespin Ida

Semester : **II**

Name of the Course : **Research Methodology**

Subject code : **PB1722**

Teaching Plan

| Unit | Modules | Topics | Lecture hours | Learning outcome | Pedagogy | Assessment/ Evaluation |
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| I. RESEARCH – INTRODUCTION | | | | | | |
| | 1 | Research- Objectives of research, Types of research, Significance | 2 | To know the objectives of research | Lecture, PPT | Short test, Quiz, Question – Answer session, Thesis evaluation, Formative Assessment I |
| | 2 | Literature collection- Index card, reference card and Abstract card | 2 | To assess the literature collection | Lecture | |
| | 3 | Literature citation- Different systems of | 3 | To evaluate the Literature | Lecture | |

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| | | citing references- Name year system, Citation sequence system and Alphabet number system | | citation | | |
| | 4 | Research report, components of a project report, tables, figures, foot note, thesis format, journal format- appendices | 3 | To understand the components of project report | Lecture, PPT, Models | |
| | 5 | E- journal and e- book. Role of supervisors/ Guides in research | 3 | To understand about E- journal and e- book | Lecture, Models | |
| II MICROSCOPY | | | | | | |
| | 1 | Microscopy – Principle, Instrumentation and uses of Light Microscope, Dark– Field Microscope | 3 | To operate microscope | Lecture, Operating microscopes | Lab test, Formative assessment, Diagrammatic representation |
| | 2 | Phase contrast Microscope, Fluorescent Microscope | 3 | To operate microscope | Lecture, Operating microscopes | |
| | 3 | Electron Microscope – SEM and TEM, Confocal Microscope | 3 | To operate microscope | Lecture, Operating microscopes | |
| | 4 | Micrometry; Photomicrometry | 3 | To measure microscopic specimens | Lecture, PPT | |
| III SPECTROPHOTOMETRY & CHROMATOGRAPHY | | | | | | |
| | 1 | Spectrophotometer - Principle, Instrumentation and uses of UV–Vis Spectrometry, Atomic Adsorption Spectrometry | 4 | Able to operate Spectrophotometer | Lecture, PPT, Operating Spectrophot ometer | Lab test, Short test, Diagrammatic representation, Formative Assessment II |
| | 2 | Nuclear Magnetic Resonance Spectrometry, Flame Photometer | 3 | Able to operate Spectrophotometer | Lecture, Operating instruments | |
| | 3 | Chromatography – Affinity | 4 | Able to perform chromatography | Lecture, Experimenta | |

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| | | Chromatography, Ion exchange chromatography and High Performance Liquid Chromatography | | | 1 approach | |
| IV CENTRIFUGATION & ELECTROPHORESIS | | | | | | |
| | 1 | Centrifugation – Principles of sedimentation, Types of rotors, Differential centrifugation, Density gradient centrifugation, Ultracentrifuge | 4 | Able to operate centrifuge | Lecture, Experimental approach | Lab test, Group discussion, Diagrammatic representation |
| | 2 | Electrophoresis – Agarose gel electrophoresis (AGE), Sodium Dodecyl Sulphate-Polyacrylamide Gel Electrophoresis (SDS-PAGE) | 4 | Able to perform electrophoretic analysis | Lecture, Experimental approach | |
| | 3 | PCR – Principle and technique. | 2 | To understand and perform PCR | Lecture, Experimental approach | |
| | 4 | Cryobiology – Lyophilization and its application in Biology | 3 | To know about the importance of Cryobiology | Lecture, PPT | |
| V BIostatISTICS | | | | | | |
| | 1 | Data collection and Analysis of data – Mean, Median, Mode, Standard deviation, Standard error | 4 | To analyse and interpret different data | Lecture, Problem solving methods | Problem solving tests, Objective type test, Formative Assessment III |
| | 2 | Student ‘T’ test, Chi – square test | 2 | To solve statistical data problems | Lecture, Problem solving methods | |
| | 3 | Correlation, Regression | 2 | To solve and correlate statistical data | Lecture, Problem solving methods | |
| | 4 | ANOVA, SPSS | 3 | To solve statistical data | Lecture, Problem solving methods | |

Course Instructor: Ms. J. Albino Wins

HOD: Dr. C. Jespin Ida

Semester : **II**
Name of the Course : **Biochemistry and Biophysics**
Subject code : **PB1723**

Teaching Plan

| Unit | Modules | Topics | Lecture hours | Learning outcome | Pedagogy | Assessment / Evaluation |
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| I CARBOHYDRATES | | | | | | |
| | 1 | Introduction - Biological processes – Carbohydrates - structure and properties of Monosaccharides - ring structure | 4 | To know about the structure and properties of biomolecules - Monosaccharides | Lecture | Class test, Group discussion, Formative Assessment I |
| | 2 | Oligosaccharides - sucrose and maltose | 3 | To understand the structure and properties of biomolecules – Oligosaccharides | Lecture, PPT | |
| | 3 | Polysaccharides - starch, cellulose, pectin and agar - Glycosidic linkage formation | 5 | To understand the structure and properties of biomolecules - Polysaccharides | Lecture, PPT | |
| II PROTEINS | | | | | | |
| | 1 | Structure and properties of amino acids and proteins - classification - Peptide bond formation | 5 | To evaluate the importance of proteins | Lecture, Charts | Class test, Question – Answer sessions, Group discussions |
| | 2 | Biologically important peptides | 2 | To critically analyze the important biological peptides | Lecture, Models | |
| | 3 | Denaturation and renaturation of proteins | 2 | To assess the difference between Denaturation and renaturation | Lecture, Charts | |

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| | 4 | Purification of proteins | 4 | To enhance the skill in purifying proteins | Lecture, Experimental approach | |
| III LIPIDS | | | | | | |
| | 1 | Lipids- Classification- Structure and properties- Triglycerides, compound lipids- phospholipids- cholesterol | 4 | To understand the structure and properties of lipids | Lecture, PPT | Class test, Question – Answer session, Formative Assessment II |
| | 2 | Structure- Biosynthesis of DNA and RNA | 3 | To evaluate the difference between the biosynthesis of DNA and RNA | Lecture, Video clippings | |
| | 3 | Secondary metabolites- Alkaloids, Glycosides, Steroids and Terpenoids. Vitamins | 5 | To assess the importance of Secondary metabolites | Lecture, Models | |
| IV ENZYMES | | | | | | |
| | 1 | Enzyme - Nomenclature and classification - IUB system – properties, Active site | 4 | To categorize enzymes | Lecture, PPT | Class test, Group discussion |
| | 2 | Mechanism of enzyme action (Fisher's Lock and Key model and Koshland's Induced fit model) - Activation energy | 4 | To understand the mechanism of enzyme action | Lecture, Video clippings | |
| | 3 | Enzyme regulation - activators and inhibitors - coenzymes. Isoenzymes | 4 | To critically analyse the regulation of enzymes | Lecture, PPT | |
| V BIOPHYSICS | | | | | | |
| | 1 | Properties of light - Different components of Electromagnetic radiation | 3 | To understand the components of Electromagnetic radiation | Lecture | Short test, Group discussions, Formative Assessment III |
| | 2 | Emission – Excitation - Fluorescence and Phosphorescence – Action and absorption spectrum- Bioluminescence | 4 | To differentiate Fluorescence and Phosphorescence | Lecture, PPT | |
| | 3 | Laws of | 4 | To know the | Lecture | |

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| | | Thermodynamics, Concept of free energy, Redox potential, Coupling of chemical reactions. High energy compounds in biology – significance | | laws and concepts of energy | | |
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Course Instructor: Ms. N. Benit

HOD: Dr. C. Jespin Ida

Semester : II Elective II (a)

Name of the Course : Medicinal Botany and Pharmacognosy

Subject code : PB1724

Teaching Plan

| Unit | Modules | Topics | Lecture hours | Learning outcome | Pedagogy | Assessment/ Evaluation |
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| I TRADITIONAL MEDICINE | | | | | | |
| | 1 | Medicinal Botany – Definition – Aim and Scope – History – Importance – Present status and future prospects of medicinal crops | 4 | Able to understand the importance of medicinal crops | Lecture | Short test, Group discussions, Formative Assessment I |
| | 2 | Traditional systems of medicine – Siddha, Ayurveda and Unani | 4 | To know the different traditional systems of medicine | Lecture, PPT | |
| | 3 | Conservation of Medicinal plants – in situ and ex situ; Herbal gardens | 4 | To understand the conservation strategies | Lecture, Visit to herbal garden | |
| II CULTIVATION OF MEDICINAL PLANTS | | | | | | |
| | 1 | Study the following plants with reference to their | 4 | Able to cultivate medicinal plants | Lecture, PPT, Visit to | Question – Answer session, |

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| | | habitat, systematic position, morphology, useful parts, cultivation of <i>Aloe vera</i> , <i>Ocimum</i> , <i>Zingiber</i> | | | botanical garden | Group discussion |
| | 2 | <i>Catharanthus roseus</i> , <i>Phyllanthus amarus</i> , | 4 | Able to cultivate medicinal plants | Lecture, PPT | |
| | 3 | <i>Emblica</i> and <i>Azadirachta</i> . | 4 | Able to cultivate medicinal plants | Lecture, PPT | |
| III OIL EXTRACTION | | | | | | |
| | 1 | Methods of extraction of oil in the following plants – Eucalyptus, Cymbopogon | 3 | Able to understand the extraction procedures | Lecture, Video clippings | Short test, Multiple choice questions, Formative Assessment II |
| | 2 | Rose and Santalum | 3 | Able to understand the extraction procedures | Lecture, Video clippings | |
| | 3 | Extraction procedures for active principles – Withaonalides, Hyocyanine, Vinblastine | 4 | Able to understand the extraction procedures | Lecture, Video clippings | |
| IV PHARMACOGNOSY | | | | | | |
| | 1 | Pharmacognosy – Definition, Classification of drugs – Morphological, Taxonomical, Pharmacological and Chemical | 4 | To understand the basics of Pharmacognosy | Lecture | Group discussions, Short test |
| | 2 | Collection and Processing of crude drugs – Antichemical, Phytochemical | 5 | Able to assess the processing of crude drugs | Lecture, Charts | |
| | 3 | Antimicrobial and Chemical | 4 | To evaluate the antimicrobial and chemical properties of drugs | Lecture, Charts | |
| V WHO GUIDELINES | | | | | | |
| | 1 | Screening and WHO standardization of crude drugs (WHO | 3 | To evaluate the standardization of crude drugs | Lecture, PPT | Multiple choice questions, |

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| | | guidelines) | | | | Group discussions, Formative Assessment III |
| 2 | Physicochemical (Ash and Extraction values) | 3 | To assess the Physicochemical parameters | Lecture, Video clippings | | |
| 3 | Fluorescence analysis – Qualitative and Quantitative analysis | 4 | To differentiate Qualitative and Quantitative analysis | Lecture | | |
| 4 | Basic chromatographic and Spectroscopic analysis of crude drugs | 3 | To evaluate the analysis of crude drugs | Lecture, Video clippings | | |

Course Instructor: Ms. J. Celin Pappa Rani

HOD: Dr. C. Jespin Ida

Semester: IV

Name of the Course: Plant Physiology and Metabolism

Subject Code: PB1741

Teaching Plan

| Unit | Modules | Topics | Lecture hours | Learning outcome | Pedagogy | Assessment/ Evaluation |
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| I ABSORPTION | | | | | | |
| | 1 | Physico-chemical properties of water - water potential; Mechanism of absorption of water - active and passive transport - Apoplast and symplast concept | 4 | To understand the mechanism of active and passive transport of water | Lecture, PPT, Video clippings | Class test, quiz, microscopic evaluation, Formative Assessment I |
| | 2 | Transpiration - Stomatal mechanism. Antitranspirants | 3 | To know the basics of transpiration | Lecture, PPT, microscopic observation | |
| | 3 | Ascent of sap – SPAC; Mineral nutrition - criteria for essentiality. Macro and micro nutrients, their role and deficiency symptoms | 4 | To evaluate the role of micro and macronutrients in plants | Lecture, experimental approach | |

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| | 4 | Absorption of solutes - passive, active diffusion and facilitated diffusion | 4 | To differentiate passive and active absorption of solutes | Lecture, video clippings | |
| | 5 | Hydroponics – Nutrient Film Technique (NFT) | 2 | To develop hydroponic technique | Lecture, PPT, Garden visit | |

II PHOTOSYNTHESIS

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| | 1 | Properties of light - Interaction between radiant energy and phosphorescence | 2 | To correlate different radiations of light | Lecture, | Online quiz, Group discussions, Class test |
| | 2 | Photosynthetic apparatus and thylakoid organization; Two pigment systems - Light harvesting systems. Reaction center, P680, P700, water oxidation complex | 3 | To understand the structure and organization in thylakoid | Lecture, PPT | |
| | 3 | Electron transport system - cyclic - non cyclic – photophosphorylation | 3 | To differentiate cyclic and noncyclic phosphorylation | Lecture, video clippings | |
| | 4 | Photosynthetic carbon reduction pathways in C3, C4 and CAM plants Photorespiration and its significance | 4 | To categorize different carbon reduction pathways | Lecture, PPT | |

III RESPIRATION & NITROGEN METABOLISM

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| | 1 | Respiration - Glycolysis – Anaerobic (Fermentation) and Aerobic (Kreb's cycle) | 3 | To understand aerobic and anaerobic respiration | Lecture, Chart | Class test, diagrammatic representation, Formative Assessment II |
| | 2 | Electron transport system and oxidative phosphorylation – mechanism, Energetics - Respiratory inhibitors - Cyanide resistant respiration; Integration | 5 | To know the basics and energetic mechanism of electron transport system | Lecture, PPT, Chart | |

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| | | of metabolic pathways | | | | |
| | 3 | Nitrogen Metabolism – Sources of nitrogen. Biological nitrogen fixation – symbiotic and asymbiotic, Nitrate and Ammonia assimilation (GS-GOGAT pathway) | 5 | To learn nitrogen metabolism in plants | Lecture, Video clippings | |
| IV PLANT GROWTH REGULATORS | | | | | | |
| | 1 | Plant growth regulators and elicitors: Physiological effect and mechanism of action of auxin, gibberellins, cytokinins, Ethylene, abscissic acid, morphactins, brassinosteroids | 5 | To know the basics of plant growth regulators and elicitors | Lecture, Chart | Class test, Group discussion, multiple choice questions, assignment on plant growth hormones |
| | 2 | Photomorphogenesis – phytochrome mediated photoresponses, Physiology of flowering; Fruit ripening | 5 | To learn about photomorphogenesis | Lecture, PPT | |
| V STRESS PHYSIOLOGY | | | | | | |
| | 1 | Physiology of senescence and abscission; Biological clock | 4 | To understand the process of ageing in plants | Lecture, Video clippings | Class test, Online quiz, Formative Assessment III |
| | 2 | Stress physiology – biotic and abiotic stress- salinity stress, drought stress, water stress, freezing stress, radiation stress, and heavy metal stress, Stress proteins in plants – stress resistance mechanism | 4 | To categorize different stress factors | Lecture, PPT | |

Course Instructor: Ms. J. Celin Pappa Rani

HOD: Dr. C. Jespin Ida

Semester:

IV

Name of the Course:

Environment and Conservation Biology

Subject Code:PB1742

Teaching Plan

| Unit | Modules | Topics | Lecture hours | Learning outcome | Pedagogy | Assessment/ Evaluation |
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| I HABITAT ECOLOGY | | | | | | |
| | 1 | Habitat Ecology - Freshwater and Marine water ecology (ecosystems), Wetlands and their Characteristics – Classification of Wetlands and Examples | 3 | To know the basics of habitat ecology | Lecture, PPT | Group discussion, Class test, Formative assessment I |
| | 2 | Succession - Causes of succession, Types of succession; Process of succession; Concept of Climatic Climax | 3 | To learn the different parameters of succession | Lecture, Charts | |
| | 3 | Hydrosere; Xerosere; Applications of ecology | 3 | To correlate and categorize hydrosere and xerosere | Lecture, PPT | |
| II ECOSYSTEM | | | | | | |
| | 1 | Structure of Ecosystem; Productivity of ecosystem; Food chains in ecosystem; Ecological Pyramids; Energy flow in ecosystem | 3 | To learn the basics of ecosystem | Lecture, Charts | Online quiz, Group discussion, Assignment on biogeochemical cycle |
| | 2 | Biogeochemical cycle – Water cycle, Gaseous cycle (Carbon cycle, Oxygen cycle, Nitrogen cycle); Sedimentary cycle | 4 | To correlate the different biogeochemical cycle | Lecture, PPT | |

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| | 3 | Ecological Genetics of Population – Ecads, Ecotypes, Ecoclines, Ecospecies, Population Ecology - Characteristics of a population; Population Structure – Population Dispersal and interactions among population | 4 | To understand the characteristics and structure of population ecology | Lecture, Charts, PPT | |
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III PHYTOGEOGRAPHY

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| | 1 | Phytogeography: Definition and Principles of Phytogeography, Distribution – Wides, Endemics and Discontinuous species; Theories of Discontinuous distribution; Factors affecting distribution of species | 4 | To learn the basics of Phytogeography | Learn, PPT | Group discussions, Class test, Formative assessment II |
| | 2 | Climate of India; Vegetation of India | 3 | To understand the climatic condition and vegetation of India | Lecture, Video clips | |
| | 3 | Global environment changes – Global warming and Ozone depletion; Bioremediation | 3 | To know about the global environmental changes | Lecture, PPT | |
| | 4 | Biofouling, Biofilm and Biocorrosion, Carbon sequestration method, Carbon trading | 4 | To categorize Biofouling, Biofilm and Biocorrosion | Online quiz, Online assignments | |

IV CURRENT PRACTICES IN CONSERVATION

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| | 1 | Current practices in conservation: Habitat or | 4 | To understand the basics of conservation | Lecture, Field visit | Class test, assessing the report of Field |
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| | | Ecosystem Approaches - Species-based Approaches - Social Approaches: Chipko Movement | | | | visit |
| 2 | In-situ conservation – Afforestation, Social Forestry, Agroforestry, Botanical gardens, Zoos | 3 | To categorize different in situ conservation methods | Lecture, PPT, Field visit | | |
| 3 | Biosphere Reserves, National Parks, Sanctuaries, Protected Area Network, Sacred Groves and Sthalavrikshas | 4 | To categorize different in situ conservation methods | Lecture, PPT, Field visit | | |
| 4 | Ex-situ conservation: Cryopreservation, Gene Banks, Seed Banks, Pollen Banks, Sperm Banks, DNA Banks | 4 | To correlate the different ex situ conservation methods | Lecture, PPT | | |

V PROTECTION OF SPECIES

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| 1 | Status and protection of species in National and International levels | 3 | To differentiate national and international level of species protection | Lecture | Formative Assessment III, seminar, Online assignment |
| 2 | Role of CITES and IUCN – Convention on Biological Diversity (CBD) | 3 | To understand the role of different treaties in species protection | Lecture, PPT | |

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| | 3 | Nagoya Protocol – Man and Biosphere Programme (MAB) | 2 | To understand the role of different treaties in species protection | Lecture, PPT | |
| | 4 | Policies implemented by MoEF for biodiversity conservation – Salient features of Biological Diversity Act 2002 – Ecosystem restoration | 3 | To know about the policies for conservation | Lecture, PPT | |

Course Instructor: Ms. L. Dyona

HOD: Dr. C. Jespin Ida

Semester: IV

Name of the Course: Applied Biotechnology

Subject Code: PB1743

Teaching Plan

| Unit | Modules | Topics | Lecture hours | Learning outcome | Pedagogy | Assessment/ Evaluation |
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| I RESTRICTION ENZYMES & LIBRARY CONSTRUCTION | | | | | | |
| | 1 | Nomenclature, classification and properties of restriction enzymes | 3 | To know the basics of restriction enzymes | Lecture, chart | Formative Assessment I, online quiz, Seminar |
| | 2 | Types of cloning vectors – Plasmids, Cosmids, ssDNA phages, Ti plasmid | 3 | To categorize different cloning methods | Lecture, PPT | |
| | 3 | Yeast vectors – YIP, YEP, YRP and YAC ; shuttle | 3 | To differentiate yeast vectors | Lecture, PPT | |

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| | | vectors | | | | |
| | 4 | Construction of genomic library; Construction of cDNA library | 3 | To construct genomic and cDNA library | Lecture, Video clippings | |
| II PLANT TISSUE CULTURE | | | | | | |
| | 1 | Plant tissue culture – laboratory organization; sterilization of explants; MS media composition and preparation of media | 4 | To construct plant tissue culture laboratory | Lecture, Video clippings | Class test, Online Assignment |
| | 2 | Meristem culture; suspension culture; protoplast culture and somatic hybridization | 3 | To learn different culture methods | Lecture, video clippings | |
| | 3 | Production of haploid plants, Somatic embryogenesis | 3 | To learn different culture methods | Lecture, video clippings | |
| | 4 | Synthetic seed production Transgenic plants – Bt cotton, Golden rice | 3 | To know about transgenic plants | Lecture, video clippings | |
| III INDUSTRIAL BIOTECHNOLOGY | | | | | | |
| | 1 | Industrial Biotechnology – Fermentor design | 2 | To design industrial fermentor | Lecture, PPT | Formative Assessment II, Assessment of Industrial Visit Report |
| | 2 | Batch culture; Continuous culture; Fed batch culture | 3 | To differentiate the different culture methods | Lecture, PPT | |
| | 3 | Immobilization of enzymes; Production of ethanol, acetic acid | 3 | To understand the production of alcohol and acids | Lecture, video clippings, Industrial Visit | |
| | 4 | Production of citric acid, Penicillin and Vitamin B ₁₂ | 2 | To understand the production of antibiotics and vitamins | Lecture, Video Clippings | |

| IV BIOSENSORS | | | | | | |
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| | 1 | Biosensors – Principle, types and applications; Biochips | 3 | To know the basics of biosensors | Lecture, PPT | Online Assignment, Group Discussion |
| | 2 | Biosafety – possible dangers of GEOs; biosafety guidelines; physical and biological containments | 4 | To differentiate the different containments | Lecture | |
| | 3 | Intellectual property rights; Process of patenting application | 3 | To know about IPR and patent rights | Lecture, PPT | |
| | 4 | Farmer's Rights and plant breeder's Rights. | 3 | To correlate Farmer's and Plant Breeder's Rights | Lecture, PPT | |
| V VACCINES & NANOTECHNOLOGY | | | | | | |
| | 1 | Edible vaccines, Plantibodies; Gene therapy – types of gene therapy, | 3 | To understand the basics of vaccines and gene therapy | Lecture | Formative Assessment III, Seminar |
| | 2 | Production of monoclonal antibodies and its application | 3 | To learn the techniques for producing MAb | Lecture, Video Clippings | |
| | 3 | Production of DNA vaccine; Production of subunit vaccine | 3 | To differentiate the different vaccine production | Lecture, Video Clipping | |
| | 4 | Nanotechnology – nanomaterials, Synthesis of nanodrugs | 3 | To know the concepts of nanotechnology | Lecture, PPT | |

Course Instructor: Ms. N. Benit

HOD: Dr. C. Jespin Ida

Semester: IV

Name of the Course: Industrial Microbiology (Elective IV)

Subject Code: PB1744

Teaching Plan

| Unit | Module | Topics | Lecture hours | Learning outcome | Pedagogy | Assessment/ Evaluation |
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| 1. SCREENING & PRODUCTION MEDIUM | | | | | | |
| | 1 | Screening and Production medium – Introduction, history and development of industrial microbiology, scope of industrial microbiology | 4 | To understand the basics of industrial microbiology | Lecture, PPT | Formative Assessment I, Online Assignent |
| | 2 | Screening techniques – Primary screening and Secondary screening; Strain development | 3 | To differentiate primary and secondary screening methods | Lecture, PPT | |
| | 3 | Preservation of microorganisms | 2 | To know about the methods of preserving microbes | Lecture | |
| | 4 | Characteristics of an ideal production medium; Raw materials used in fermentation medium | 3 | To characterize the different raw materials for fermentation | Lecture, PPT | |
| II FERMENTATION | | | | | | |
| | 1 | Fermentation Process – Basic structure of a fermentor | 3 | To construct the fermentor | Lecture, Model | Group Discussion, Class Test |
| | 2 | Batch culture, Continuous culture, Semi continuous culture, | 3 | To correlate different culture methods | Lecture, PPT | |

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| | | Fed batch culture | | | | |
| | 3 | Growth kinetics of microorganisms | 3 | To understand the growth kinetics of microorganisms | Lecture | |
| | 4 | Classification of fermentation process, Sterilization of equipment, media and air | 4 | To classify the process and sterilization in fermentation | Lecture, Video Clippings | |
| III TYPES OF FERMENTOR | | | | | | |
| | 1 | Types of fermentor – Buble column reactor, Airlift fermentor, Fluidized bed reactor, Tower fermentor | 3 | To categorize the different types of fermentor | Lecture, PPT | Formative Assessment II, Online Quiz |
| | 2 | Immobilization – Methods of immobilization, Different types of immobilized enzyme reactors | 4 | To correlate the different types of immobilized enzyme reactors | Lecture, PPT | |
| | 3 | Solid – Liquid separation methods; Liquid – liquid extraction | 3 | To differentiate the extraction methods | Lecture, Video Clippings | |
| | 4 | Physical, Chemical and enzymatic methods of cell disruption | 4 | To understand the methods of cell disruption | Lecture, PPT | |
| IV MICROBIAL PRODUCTION OF FOOD | | | | | | |
| | 1 | Microbial production of food – Production of single cell protein (SCP); Production of Bakers yeast; | 3 | To know the microbial production of various foods | Lecture, PPT | Class test, Group Discussion |
| | 2 | Production of bread, Production | 4 | To know the microbial | Lecture, Video | |

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|--|---|--|---|---|--------------------------------|--|
| | | of wine; Production of beer; | | production of various foods | Clippings, Preparation of wine | |
| | 3 | Production of whisky, Production of sauerkraut; Preparation of cheese. | 3 | To know the microbial production of various foods | Lecture, Video Clippings | |

V PRODUCTION OF USEFUL PRODUCTS

| | | | | | | |
|--|---|--|---|--|--------------------------|---|
| | 1 | Production of useful products – Antibiotics – Penicillin, Streptomycin; | 4 | To learn the production of antibiotics | Lecture, PPT | Formative Assessment III, Question and Answer session |
| | 2 | Production of Organic acids - Citric acid, Acetic acid; | 3 | To learn the production of organic acids | Lecture, PPT | |
| | 3 | Production of Enzyme - Amylase enzyme; Solvents - Ethyl alcohol; Amino acid - Glutamic acid; Vitamin – Vitamin B ₁₂ . | 4 | To understand the production of enzymes and vitamins | Lecture, Video Clippings | |

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