**M. Sc. Environmental Science (2nd Semester)**

**(Session: 2014-2015)**

**MES -201 (NATURAL RESOURCE MANAGEMENT)**

**(Unit –I & II) (Er. Meenakshi Suhag)**

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| --- | --- | --- | --- |
| **S.No** | **Month** | **Hour/ Lecture** | **Topic** |
| **1** |  | 02 | Resources and types of resources |
| 02 | Renewable resources |
| 01 | Non-renewable resources |
| 01 | Resource degradation |
| 01 | Resource conservation |
| 01 | Human impact on natural resources |
| **2** | **February** | 01 | Exploitation of resources |
| 01 | Land resources |
| 01 | Land degradation |
| 01 | Desertification |
| 01 | Soil erosion and control |
| 01 | Reclamation & management of waste lands with special reference to India |
| 01 | Water resources and pools of water |
| 01 | Hydrological cycle |
| **3** | **March** | 01 | Surface water and ground water |
| 01 | Human use of freshwater |
| 01 | Rain water harvesting |
| 01 | Watershed management |
| 01 | Biodiversity gradient – latitudinal |
| 01 | Biodiversity gradient – altitudinal |
| 01 | Regional patterns of biodiversity |
| 01 | Factors affecting biodiversity patterns |
| **4** | **April** | 01 | Biodiversity functioning |
| 02 | Ecosystem functioning |
| 01 | Terrestrial hotspot of biodiversity |
| 01 | Marine hotspot of biodiversity |
| 01 | Biodiversity of mangroves – A general account |
| 01 | Biodiversity of wetlands – A general account |
| 01 | Biodiversity of coral reefs – A general account |

**MES -201 (NATURAL RESOURCE MANAGEMENT)**

**(Unit –III) (Dr. Ashwani Sharma)**

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| --- | --- | --- | --- |
| **S. No** | **Month** | **Hour/ Lecture** | **Topic** |
| **1** | **January** | 01 | Introduction to forest resources: Forests, their importance, types, global distribution etc |
| 01 | Forests resources including primary and secondary products |
| 01 | Forests resources in India and their geographical distribution |
| 01 | Deforestation and its impacts, examples of deforestation, slash and burn forests destruction |
| **2** | **February** | 01 | Concept of sustainable development and its extension to forests resources |
| 01 | Concept of sustainable forests and sustainable forests management practices |
| 01 | Examples and case studies of sustainable forests management |
| 01 | Range land, its classification and types |
| **3** | **March** | 01 | Grassland ecosystem its types and examples |
| 01 | Importance of grasslands and contemporary issues |
| 01 | Grassland management overall and management strategies in India |
| 01 | Medicinal plants and its importance with examples |
| **4** | **April** | 01 | Medicinal plant resources and bioprospecting |
| 01 | Introduction of marine ecosystem and resources |
| 01 | Fisheries as an important marine resources with examples |
| 01 | Introduction to aquaculture, types of fishes, its relevance and need |

**MES -201 (NATURAL RESOURCE MANAGEMENT)**

**(Unit –IV) (Mrs. Dipti )**

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| --- | --- | --- | --- |
| **S. No** | **Month** | **Hours/ Lectures** | **Topic** |
|  | **January** | 01 | Economic categories of Resources |
| 01 | Market, Environment and Natural resources |
| 01 | Economics theory- Market, Demand and Supply relationships |
| 01 | The limit of growth |
|  | **February** | 01 | Cost Benefit Ratio |
| 01 | Natural Resources Accounting |
| 01 | Price based mechanisms for Environmental Protection |
| 01 | Credit based & market friction based mechanisms for Environmental Protection |
|  | **March** | 01 | Market friction based mechanisms for Environmental Protection |
| 01 | Economically sustainable forest management designs |
| 01 | Green Certification |
| 01 | Resource Conservation |
|  | **April** | 01 | Community Forest Management |
| 01 | Ecotourism |
| 01 | Economic efficient model of Sustainable Fisheries |
| 01 | Designs for Renewable Energy Resources |

**M. Sc. Environmental Science (2nd Semester)**

**(Session: 2014-2015)**

**MES -202 (CONSERVATION AND BIODIVERSITY)**

**(Unit –I & IV) (Er. Meenakshi Suhag)**

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| --- | --- | --- | --- |
| **S. No** | **Month** | **Hour/ Lecture** | **Topic** |
| **1** | **January** | 02 | Basic concepts of conservation biology |
| 02 | Principles conservation biology |
| 02 | Importance of conservation biology |
| 02 | Threats to conservation biology |
| **2** | **February** | 02 | Genetic variations |
| 02 | Natural selection |
| 01 | Genetic drift |
| 01 | Gene flow |
| 02 | Variations in genetic diversity |
| **3** | **March** | 01 | Minimum viable populations |
| 01 | Genetic swamping |
| 02 | Biodiversity and its levels |
| 02 | Magnitude and global accumulation of biodiversity |
| 02 | Vertical distribution of species |
| **4** | **April** | 01 | Species diversity |
| 01 | Genetic diversity |
| 02 | Ecosystem diversity |
| 02 | Species diversity indices |
| 02 | Rank abundance patterns |

**MES -202 (CONSERVATION AND BIODIVERSITY)**

**(Unit –II & III) (Mrs. Dipti)**

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| --- | --- | --- | --- |
| **Sr. No** | **Month** | **Hours/ Lectures** | **Topic** |
|  | **Jan** | 01 | Introduction to Biodiversity |
| 01 | Latitudinal Biodiversity gradient |
| 01 | Altitudinal Biodiversity gradient |
| 01 | Regional patterns of biodiversity |
| 01 | Factors affecting biodiversity patterns |
| 01 | Theories of diversities |
| 01 | Biodiversity and ecosystem functioning |
| 01 | Concept of extinction |
|  | **Feb** | 01 | Distribution of Biodiversity |
| 01 | Terrestrial hotspots of biodiversity |
| 01 | Marine hotspots of biodiversity |
| 01 | Biodiversity of mangroves |
| 01 | Biodiversity of wetlands |
| 01 | Biodiversity of coral reefs |
| 01 | Biodiversity uses |
| 01 | Ecosystem services through biodiversity |
|  | **March** | 01 | Threats to biodiversity |
| 01 | Habitat loss |
| 01 | Habitat Fragmentation |
| 01 | Exotic Species |
| 01 | Environmental Pollution |
| 01 | Species Extinction |
| 01 | IUCN threat categories |
| 01 | global and national status; |
|  | **April** | 01 | Threats to aquatic and marine biodiversity. |
| 01 | Endangered and threatened species of India |
| 01 | Prepration of Biodiversity Inventory |
| 01 | List of Endangered species |
| 01 | List of Threatened species in india |
| 01 | Biodiversity assessment |
| 01 | Biodiversity monitoring at state level |
| 01 | Biodiversity monitoring at regional level |

**M. Sc. Environmental Science (2nd Semester)**

**(Session: 2014-2015)**

**MES -203 (POLLUTION AND GLOBAL CLIMATE CHANGE)**

**(Unit –I & II) (Ms. Bhawna Dahiya )**

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| --- | --- | --- | --- |
| **Sr. No** | **Month** | **Hours/ Lectures** | **Topic** |
|  | **January** | 01 | Sources, classification and physical and chemical properties of air pollutants |
| 01 | Behaviour and environmental fate of air pollutants, |
| 01 | Effects of air pollution on human health and on environment |
| 01 | Sampling and analysis of air pollutants |
| 01 | Sampling and analysis of SOx and NOx |
| 01 | Sampling and analysis of Carbon monooxide |
| 01 | Sampling and analysis of ozone |
| 01 | Sampling and analysis of different hydrocarbons and particulate matter |
|  | **February** | 01 | Meteorological aspects of air pollutant dispersion |
| 01 | Air quality standards at International and National levels |
| 01 | General introduction and various sources of Noise pollution |
| 01 | Effects of noise pollution on human health |
| 01 | Noise-monitoring-sound level meter |
| 01 | Sources and consequences of water pollution |
| 01 | Ecological aspects of water pollution |
| 01 | Biochemical aspects of water pollution |
|  | **March** | 01 | Physical, chemical and biological characteristics of domestic waste |
| 01 | Physical, chemical and biological characteristics of industrial and agricultural wastes |
| 01 | Effects of domestic wastes on aquatic and marine water bodies |
| 01 | Effects of industrial and agricultural wastes on aquatic and marine water bodies |
| 01 | Sources ,effects and remediation of Thermal pollution |
| 01 | Sources,effects and remediation of Marine pollution |
| 01 | Physical, chemical and biological parameters for water quality standards |
| 01 | Water quality standards at International and National levels |
|  | **April** | 01 | Soil pollution from use of different fertilizers |
| 01 | Soil pollution from use of pesticides |
| 01 | Soil pollution from use of heavy metals |
| 01 | Soil pollution from improper waste disposal |
| 01 | Soil pollution through industrial effluents |
| 01 | Soil pollution through surfactants |
| 01 | Detrimental effects of soil pollutants on ecosystem |
| 01 | Remedial measures for soil pollution |

**MES -203 (POLLUTION AND GLOBAL CLIMATE CHANGE)**

**(Unit –III) (Prof. Smita Chaudhry)**

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| --- | --- | --- | --- |
| **Sr. No** | **Month** | **Hours/ Lectures** | **Topic** |
|  | **January** | 01 | Global climate change phenomena |
| 01 | Sources of green house gas emissions and their effects |
| 01 | Recent trends in greenhouse gas emissions |
| 01 | Radiative forcing of gases |
|  | **February** | 01 | Warming potential of gases |
| 01 | CO2 fertilization effect on plants |
| 01 | Potential impacts of global warming |
| 01 | Impacts of global warming on polar ice caps and melting of glaciers |
|  | **March** | 01 | Potential impacts of global warming on sea level rise |
| 01 | Potential impacts of global warming and weather extremes on Tropical ecosystems |
| 01 | Potential impacts of global warming and weather extremes on Temperate ecosystems |
| 01 | Potential impacts of global warming and weather extremes on human health |
|  | **April** | 01 | Coral reef bleaching |
| 01 | Surface ocean chemistry |
| 01 | Biogenic calcification in oceans |
| 01 | Mitigation options for climate change |

**MES -203 (POLLUTION AND GLOBAL CLIMATE CHANGE)**

**(Unit –IV) (Ms. Shivani)**

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No** | **Month** | **Topic** | **Hours/Lectures** |
|  | **January** | Introduction, Tools to study global climate change | 1 |
| Paleoclimatic records, Dendroclimatology | 1 |
| General circulation models | 2 |
|  | **February** | Ice cores | 1 |
| Mitigation strategies for global warming | 1 |
| Carbon sequestration and its types Biological | 2 |
|  | **March** | Carbon sequestration in geological formations | 1 |
| Role of forests in soil carbon storage | 1 |
| Kyoto protocol, history, outcomes | 1 |
| Carbon trading | 1 |
|  | **April** | Global environmental change programmes | 1 |
| IPCC and its role in Climate change | 1 |
| Indian initiative for mitigating global climate change | 2 |

**M. Sc. Environmental Science (2nd Semester)**

**(Session: 2014-2015)**

**MES -204 (ENVIRONMENTAL METHODS AND ANALYTICAL TECHNIQUES)**

**(Unit –I) (Mrs. Dipti)**

|  |  |  |  |
| --- | --- | --- | --- |
| S. No | Month | Hours/ Lectures | Topic |
|  | **January** | 01 | Analytic characters of Vegetation |
| 01 | Synthetic characters of Vegetation |
| 01 | Introduction to methods of Vegetation Analysis |
| 01 | Quadrat method of vegetation analysis |
|  | **February** | 01 | Line transect method of vegetation analysis |
| 01 | Measurement of Diversity |
| 01 | Species Diversity |
| 01 | Indices of diversity |
|  | **March** | 01 | Primary and Secondary Production |
| 01 | Harvest method of measuring Primary productivity |
| 01 | Chlorophyll measurement method of measuring Primary productivity |
| 01 | Methods of measurement of primary productivity for aquatic ecosystem |
|  | **April** | 01 | Estimation of Ecosystem Nutrient Budget |
| 01 | Germplasm Evaluation |
| 01 | Germplasm Conservation methods |
| 01 | Techniques for quantifying nitrogen fixation |

**MES -204 (ENVIRONMENTAL METHODS AND ANALYTICAL TECHNIQUES)**

**(Unit –II & III) (Dr. Ashwani Sharma)**

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| --- | --- | --- | --- |
| **S. No** | **Month** | **Hour/ Lecture** | **Topic (s)** |
| **1** | **January** | 01 | Basic principles of environmental microbiology and its importance |
| 01 | Techniques in environmental microbiology, types of media, types of microbes, media preparation, culturing techniques |
| 01 | Concept of culturable and un culturable microbes including metagenomics and its art |
| 01 | Soil microbial population diversity and population estimation, techniques involved and importance |
| 01 | Account of microbial activity in soil and environmental samples, respiration, biomass |
| 01 | Techniques involved in measurement of microbial activity, growth curves etc |
| 01 | Mineralization of complex organic and inorganic substances, biomass increase, aerobic and anaerobic respiration |
| 01 | Mineralization of nitrogen and its uses |
| **2** | **February** | 01 | Enzymes involved in microbial activity, importance of enzyme, its classification |
| 01 | Introduction to bio-fertilizers, its types |
| 01 | Introduction to VAM, its types, its functions and important in plant growth |
| 01 | Soil, plant, fungal associations, assessment and characterization of VAM in higher plants |
| 01 | Relevance of instrumentation in environmental sample analysis |
| 01 | Introduction to spectrophometry, its types (UV, visible, IR) |
| 01 | Principles and types of absorption, emission and scattering based instruments |
| 01 | Lambert-Beer law and its applications and its relation with absorbance etc |
| **3** | **March** | 01 | Introduction of flame photometry, its principle, application and relevance |
| 01 | Atomic absorption spectrophotometer, its principle, applications, sample preparation, importance |
| 01 | Basic fundamentals of chromatography, brief introduction on types and principles |
| 01 | Mobile, stationary phase, different types of chromatographic techniques |
| 01 | Types and examples of planar and column chromatography |
| 01 | Introduction to paper chromatography, mobile and stationary phases, detection techniques, advantages and limitations |
| 01 | Introduction to thin layer chromatography (TLC), mobile and stationary phases, detection techniques, advantages and limitations |
| 01 | Gas liquid chromatography and gas solid/ liquid chromatography, its principle, applications and real difference |
| **4** | **April** | 01 | Principle of high pressure liquid chromatography (HPLC) |
| 01 | Sample preparation for HPLC, chemical properties of samples |
| 01 | Difference in the functioning of HPLC vis-à-vis GLC/ GSC etc, mode of operation |
| 01 | The concept of ion exchange, ionic interactions |
| 01 | The use and relevance of ion exchange concept in chromatographic separations ion exchange chromatography |
| 01 | Basics and principle of fluorometry and types of samples to be analyzed, concept of scattering |
| 01 | Concept of diffraction of light, its various theories |
| 01 | X Ray diffraction, its principle, its scope, application, advantages and limitations |

**MES -204 (ENVIRONMENTAL METHODS AND ANALYTICAL TECHNIQUES)**

**(Unit –IV) (Ms. Shivani)**

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| --- | --- | --- | --- |
| **Sr. No** | **Month** | **Hours/ Lectures** | **Topic** |
|  | **January** | 01 | Environmental Samples and Analysis: Introduction |
| 01 | Methods of sampling particulate pollution in air |
| 01 | Methods of sampling gaseous pollution in air |
| 01 | Methods of analyzing particulate pollution in air |
|  | **February** | 01 | Methods of analyzing SOx pollution in air |
| 01 | Methods of analyzing NOx pollution in air |
| 01 | Methods of analyzing other gaseous pollution in air |
| 01 | Physico-chemical and biological parameters for water analysis |
|  | **March** | 01 | Analysis of water samples: (Temperature, pH, Conductivity, TDS, SS, Turbidity) |
| 01 | Analysis of water samples: (DO, BOD, COD, Calcium+Magnesium, Chloride, Fluoride etc.) |
| 01 | Analysis of water samples: (Sodium, Potassium, Phosphorus, Nitrates, Heavy Metals etc.) |
| 01 | Bacteriological Analysis of water samples |
|  | **April** | 01 | Soil analysis - sample preparation |
| 01 | Soil analysis (Temperature, pH, Conductivity, Bulk Density, soil aggregates etc) |
| 01 | Analysis of soil samples: (Total Carbon, Organic Carbon, Inorganic Carbon, Calcium+Magnesium, Chloride, etc.) |
| 01 | Analysis of soil samples: (Sodium, Potassium, Phosphorus, Total Nitrogen, Available Nitrogen, Heavy Metals etc.) |

**M.Sc. Environmental Science (4th Semester)**

**(Session: 2014-2015)**

**MES -401 (AGRECOLOGY AND AGROFORESTRY)**

**(Unit –I) (Mrs. Pooja)**

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| --- | --- | --- | --- |
| **Sr. No** | **Month** | **Hours/ Lectures** | **Topic** |
|  | **January** | 01 | Introduction to Agroecology |
| 01 | Agricultural ecosystems: concept, characteristics and processes |
| 01 | Agricultural practices: on farm and off farm practices and animal husbandry, GAPs |
| 01 | Green revolution-environmental implications |
|  | **February** | 01 | Shifting agriculture: Patterns and Problems |
| 01 | Possible Improvements for shifting agriculture |
| 01 | Sustainable agriculture |
| 01 | Organic farming |
|  | **March** | 01 | Eco-farming |
| 01 | Dry-land farming |
| 01 | Zero-tillage |
| 01 | Biofertilizer |
|  | **April** | 01 | Plant growth promoting bacteria |
| 01 | Consequences of modern agriculture |
| 01 | Conservation agriculture and role of agro-biodiversity |
| 01 | Approaches for sustainable use of agro-biodiversity |

**MES -401 (AGRECOLOGY AND AGROFORESTRY)**

**(Unit –II) ( Ms. Shivani)**

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| --- | --- | --- | --- |
| **Sr. No** | **Month** | **Hours/**  **Lectures** | **Topic** |
|  | **January** | 01 | Environmental impacts of agriculture |
| 01 | Types of Soils and their impact on agricultural productivity |
| 01 | Different Irrigation practices with their advantages and limitations |
| 01 | Problem of water logging and secondary salinization with case studies in context to India |
|  | **February** | 01 | Classification of agrochemicals |
| 01 | Types and impacts of pesticide residues on environment |
| 01 | Crop Protection |
| 01 | Positive and negative impacts of biodegradable pesticides on agriculture |
|  | **March** | 01 | Positive and negative impacts of Non-biodegradable pesticides on agriculture |
| 01 | Impacts of pesticide resistance organisms on agriculture |
| 01 | Role of Biological pest control on crop productivity |
| 01 | Ecological pest control in agricultural system |
|  | **April** | 01 | Integrated pest management for crop productivity |
| 01 | Pesticide safety and microbial insecticides |
| 01 | Biosafety issues in agriculture |
| 01 | The role of microbes in agriculture-beneficial root-microbial interaction. |

**MES -401 (AGRECOLOGY AND AGROFORESTRY)**

**(Unit -III & IV) ( Ms. Bhawna Dahiya)**

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| --- | --- | --- | --- |
| **Sr. No** | **Month** | **Hours/ Lectures** | **Topic** |
|  | **January** | 01 | Introduction to agroforestry techniques |
| 01 | Scope and importance of agroforestry system |
| 01 | Classification of different types of agroforestry systems |
| 01 | Types of various traditional agroforestry systems of India |
| 01 | Advantages and drawbacks of various traditional agroforestry systems of India |
| 01 | Agroforestry for soil conservation and management |
| 01 | Case studies for soil conservation through agroforestry methods |
| 01 | Agroforestry for carbon sequestration |
|  | **February** | 01 | Case studies for carbon sequestration through agroforestry methods |
| 01 | Agroforestry for mitigating climate change and its impact on productivity |
| 01 | Case studies for mitigating climate change through agroforestry methods |
| 01 | Agroforestry for conserving soil biodiversity |
| 01 | Case studies for conserving soil biodiversity through agroforestry methods |
| 01 | Various soil and water and nutrient conservation models of agroforestry systems |
| 01 | Advantages and limitations of various models of agroforestry systems |
| 01 | Seed quality determination |
|  | **March** | 01 | Characteristics for measuring Seed quality |
| 01 | Physical methods of Seed testing |
| 01 | Chemical methods of Seed testing |
| 01 | Biological methods of Seed testing |
| 01 | Hybrid seed production |
| 01 | Application of hybrid seeds |
| 01 | Seed regulatory system in India |
| 01 | Rules and regulations for seed regulation system |
|  | **April** | 01 | Seed certification systems at International level |
| 01 | Seed certification systems at National level |
| 01 | Soil productivity through crop residue management |
| 01 | Impact of weather on crop productivity |
| 01 | Positive impact of global warming on agriculture |
| 01 | Negative impact of global warming on agriculture |
| 01 | Positive impact of global warming on food security |
| 01 | Negative impact of global warming on food security |

**M.Sc. Environmental Science (4th Semester)**

**(Session: 2014-2015)**

**MES -402 (ENVIRONMENTAL IMPACT ASSESSMENT AND AUDITING)**

**(Unit – I & II) (Mrs. Dipti)**

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| --- | --- | --- | --- |
| **Sr. No** | **Month** | **Hours/ Lectures** | **Topic** |
|  | **January** | 01 | Basic introduction of EIA |
| 01 | Origin of EIA |
| 01 | Development of EIA |
| 01 | Aims and Purpose of EIA |
| 01 | Methods of assessment of EIA |
| 01 | Core values of EIA |
| 01 | Principles of EIA |
| 01 | Baseline study of the site |
|  | **February** | 01 | EIA Methodology |
| 01 | EIA processes |
| 01 | Project screening |
| 01 | Scoping of project |
| 01 | base-line data and evaluation |
| 01 | impact identification and prediction |
| 01 | valuation of environmental impacts |
| 01 | environmental impacts, mitigation |
|  | **March** | 01 | Public participation |
| 01 | review and decision making |
| 01 | monitoring and auditing |
| 01 | Environmental Management Plan |
| 01 | Environmental components of EIA |
| 01 | Environmental Appraisal procedures in India |
| 01 | Impact identification methods |
| 01 | Environmental impacts of mining industry |
|  | **April** | 01 | Environmental impacts of nuclear power plant |
| 01 | Environmental impacts of textile industry |
| 01 | Environmental impacts of pulp and paper industry |
| 01 | Environmental impacts of petroleum refining |
| 01 | Environmental impacts of pesticide manufacturing industry |
| 01 | Case studies of EIA – Hydroelectric dam |
| 01 | Case studies of EIA- thermal power plants |
| 01 | Case studies of EIA- petroleum exploration |

**MES -402 (ENVIRONMENTAL IMPACT ASSESSMENT AND AUDITING)**

**(Unit – III) (Dr. Hardeep Rai Sharma)**

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| --- | --- | --- | --- |
| **S. No** | **Month** | **Topic** | **Hours/ Lectures** |
|  | **January** | Risk Analysis: Definition of risk | 1 |
| Environmental risk analysis-risk assessment and risk management | 2 |
| Basic steps in risk assessment-hazard identification | 1 |
|  | **February** | Dose-response assessment | 1 |
| Exposure assessment | 2 |
| Risk characterization | 1 |
|  | **March** | Risk characterization | 1 |
| Risk assessment in EIA | 1 |
| Uncertainties in Risk Assessment | 1 |
| Strategic Environmental Assessment | 1 |
|  | **April** | (SEA)-principles and potential | 2 |
| SEA –case study | 1 |
| Improving the effectiveness of EIA | 1 |

**MES -402 (ENVIRONMENTAL IMPACT ASSESSMENT AND AUDITING)**

**(Unit – IV) (Dr. Sandeep Gupta)**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No** | **Month** | **Topic** | **Hours/ Lectures** |
|  | **January** | Aims and objectives of public involvement in EIA | 2 |
| Public involvement methods | 2 |
|  | **February** | Approaches for EIA reviewing | 1 |
| Economic efficiency and valuation Methods | 2 |
| Types of environmental audits: Assessment and compliance audit | 1 |
|  | **March** | Occupation health and safety audits,  Energy audits | 2 |
| Environmental Management systems in India | 1 |
| ISO 14001 | 1 |
|  | **April** | Drivers for the development of audit programme | 1 |
| General audit process- preparation, excretions, performance valuation and execution | 2 |
| Environmental risk insurance, Environmental audit and EIA | 1 |

**M.Sc. Environmental Science (4th Semester)**

**(Session: 2014-2015)**

**MES -403 (ECOTECHNOLOGY AND ECOLOGICAL RESTORATION)**

**(Unit –I) (Prof. Smita Chaudhry )**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sr. No** | **Month** | **Hours/ Lectures** | **Topic** |
|  | **January** | 01 | Basic principles of Ecotechnology and Ecological Engineering |
| 01 | Applications of Ecotechnology and other technologies |
| 01 | Restoration Ecology-Terms and definitions |
| 01 | Importance of ecological restoration and processes |
|  | **February** | 01 | Strategies of Restoration-Natural recovery |
| 01 | Active restoration processes |
| 01 | Rehabilitation and measures for rehabilitation |
| 01 | Restoration plan and Reference ecosystems |
|  | **March** | 01 | Characteristics and sources of Natural disturbances in ecosystems: Overview and types |
| 01 | Anthropogenic disturbances in ecosystem |
| 01 | Effects of disturbances on structure and functioning of terrestrial ecosystems |
| 01 | Effects of disturbances on structure and functioning of aquatic ecosystems |
|  | **April** | 01 | Habitat fragmentation |
| 01 | Ecosystem Stability and regulation |
| 01 | Impact of global change on ecological systems |
| 01 | Impact of human impact on ecological systems |

**MES -403 (ECOTECHNOLOGY AND ECOLOGICAL RESTORATION)**

**(Unit –II) ( Mrs. Pooja)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sr. No** | **Month** | **Hours/ Lectures** | **Topic** |
|  | **January** | 01 | Introduction to Ecological Restoration |
| 01 | Physical, Chemical and Biological tools of restoration |
| 01 | Ecological Design Principles |
| 01 | Causes and consequences of land degradation |
|  | **February** | 01 | Restoration of soil fertility of degraded lands: overview |
| 01 | Restoration of soil fertility of degraded lands: No-Tillage |
| 01 | Restoration of soil fertility of degraded lands: role of mycorrhizae |
| 01 | Restoration of soil fertility of degraded lands: forestry plantations |
|  | **March** | 01 | Restoration of soil fertility of degraded lands: biofertilizers |
| 01 | Types, causes and problems of soil salinity |
| 01 | Strategies for rehabilitation of salt affected soils |
| 01 | Causes and problems of water logging |
|  | **April** | 01 | Measures for rehabilitation of water logged soils |
| 01 | Biosaline agriculture- Introduction |
| 01 | Biosaline agriculture- Scope and importance |
| 01 | Biosaline agriculture- strategies |

**MES -403 (ECOTECHNOLOGY AND ECOLOGICAL RESTORATION)**

**(Unit –III & IV) ( Ms. Bhawna Dahiya)**

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| --- | --- | --- | --- |
| **Sr. No** | **Month** | **Hours/ Lectures** | **Topic** |
|  | **January** | 01 | Forest ecosystems and its types |
| 01 | Active and passive methods for restoration of forest ecosystems |
| 01 | Case studies of restoration of forest ecosystems |
| 01 | Grassland ecosystems and its types |
| 01 | Active and passive methods for ecological restoration of grassland ecosystems |
| 01 | Case studies of restoration of grassland ecosystems |
| 01 | Forest landscape general introduction |
| 01 | Importance of stakeholders in Forest landscape restoration |
|  | **February** | 01 | Case studies of Forest landscape restoration |
| 01 | Impacts of different anthropogenic activities on mining sites |
| 01 | Case studies of reclamation of mining sites |
| 01 | Natural and anthropogenic causes of disturbed lands |
| 01 | Different techniques for reclamation of disturbed lands |
| 01 | Case studies for reclamation of disturbed sites |
| 01 | Integrated watershed management and restoration |
| 01 | Prevention and mitigation of invasive species |
|  | **March** | 01 | Importance of River corridors |
| 01 | Causes of degradation of river corridors |
| 01 | Restoration of river corridors |
| 01 | Causes of degradation and importance of wetlands |
| 01 | Different methods of ecological restoration of wetlands |
| 01 | Natural and anthropogenic causes of degradation of lakes |
| 01 | Restoration and case studies of lakes |
| 01 | Importance of mangroves in coastal zone management |
|  | **April** | 01 | Causes of degradation and restoration of mangroves |
| 01 | Causes of degradation of coral reefs |
| 01 | Restoration of coral reefs |
| 01 | Rehabilitation of Tsunami affected areas- a general account |
| 01 | Difference between Treatment wetlands and Constructed wetlands |
| 01 | Adaptive restoration of wetlands |
| 01 | Importance, degradation and restoration of riparian ecosystems |
| 01 | Importance, degradation and restoration of floodplain ecosystems |

**M.Sc. Environmental Science (4th Semester)**

**(Session: 2014-2015)**

**MES -404 (ECOLOGICAL ECONOMICS)**

**(Unit –I and II) ( Mrs. Pooja)**

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| --- | --- | --- | --- |
| **Sr. No** | **Month** | **Hours/ Lectures** | **Topic** |
|  | **January** | 01 | Ecological Economics: Overview |
| 01 | Scope and importance of ecological economics |
| 01 | Economics and environmental policy |
| 01 | The market mechanisms and choices |
| 01 | Cost and Benefits of environmental protection |
| 01 | Law of Demand and Supply |
| 01 | Movement and shifts in Demand and Supply |
| 01 | Relationship of demand to WTP |
|  | **February** | 01 | Market success and market failure |
| 01 | Market price and quality |
| 01 | Environmental externalities and the problem of social cost |
| 01 | Types and significance of ecosystem services |
| 01 | Total Economic Value of ecosystem services |
| 01 | Direct market valuation approaches for ecosystem services |
| 01 | Stated and Revealed preference approaches for valuation of ecosystem services |
| 01 | Value addition in agriculture crops, Agricultural marketing |
|  | **March** | 01 | Assessing the benefits and cost of mitigating climate change |
| 01 | Choice of instruments for climate change policy |
| 01 | Key elements for international framework for climate change mitigation |
| 01 | Benefits and cost of controlling greenhouse gases |
| 01 | carbon trading and CDM mechanisms |
| 01 | Measuring the costs and benefits of pollution control |
| 01 | Overview of benefit-cost analysis |
| 01 | Economic principles of cost benefit analysis |
|  | **April** | 01 | Contingent valuation method |
| 01 | Travel cost methods |
| 01 | Hedonic market methods |
| 01 | Market based instruments for controlling pollution |
| 01 | Rationale for environmental accounting and system of national accounts (SNA) |
| 01 | Flaws in conventional system of accounting |
| 01 | System of integrated Environmental and Economic Accounting (SEEA) |
| 01 | Green accounting |

**MES -404 (ECOLOGICAL ECONOMICS)**

**(Unit –III and IV) ( Dr. Sandeep Gupta)**

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| **S. No** | **Month** | **Topic** | **Hours/ Lectures** |
|  | **January** | Definition and dimensions of sustainability | 1 |
| Global challenges of sustainable development | 1 |
| The ecological footprint | 1 |
| Ecological and Economic sustainability of Natural resources -a general account | 2 |
| An economic perspective to sustainability | 1 |
| Guiding principles of sustainable development | 2 |
|  | **February** | Sustainability indicators | 1 |
| Models of sustainability | 2 |
| Environmental sustainability index | 1 |
| National sustainable development strategies | 2 |
| Decoupling | 1 |
| Green Economy | 1 |
|  | **March** | Other Strategies for global sustainability | 1 |
| Global environmental monitoring and assessment | 2 |
| Global action and sustainable development | 2 |
| Instruments for implementing sustainability- Findings right prices | 2 |
| Steady State principles | 1 |
|  | **April** | The Hardwick-Solow Rule | 2 |
| Critical rental capital | 2 |
| Safe Minimum Standard | 2 |
| Education for Sustainability | 1 |
| Policy implications for implementing sustainability | 1 |

**M.Tech. (Energy & Environmental Management) (2nd Semester)**

**(Session: 2014-2015)**

**MEMT -201 (ENVIRONMENTAL ASSESSMENT & MANAGEMENT)**

**(Unit – I and II) (Dr. Hardeep Rai Sharma)**

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No** | **Month** | **Topic** | **Hours/ Lectures** |
|  | **January** | National environmental polices 2006 - introduction, approaches and objectives, | 2 |
| National environmental polices 2006 - principles and frameworks | 1 |
| Purposes and aims of environmental impact assessment | 1 |
| Environmental Inventory | 1 |
| Major trends in EIA and Benefits of applying EIA to proposals | 1 |
| Steps in the EIA process | 1 |
| EIA methodology | 1 |
|  | **February** | Project screening, scoping, base-line data | 1 |
| EIA and Stakeholder Involvement, Types of participation | 2 |
| Impact identification and its types | 1 |
| Methods of Impact Identification | 1 |
| Impact Prediction, evaluation, valuation of environmental impacts | 2 |
| Environmental Impact Assessment Reports | 1 |
|  | **March** | Mitigation, public participation, presentation | 2 |
| Review and decision making, monitoring | 1 |
| Environmental Auditing and it types and process | 2 |
| Environmental Management Plan | 2 |
| Environmental components of EIA | 1 |
|  | **April** | Environmental procedures in India, Impact, identification and methods | 2 |
| Case studies of EIA of hydroelectric dam and river valley project | 2 |
| Case studies of EIA of Thermal power plants and petroleum exploration | 2 |
| Types of environmental audits , Environmental audit and EIA | 2 |

**MEMT -201 (ENVIRONMENTAL ASSESSMENT & MANAGEMENT)**

**(Unit – III) (Ms. Shivani)**

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No** | **Month** | **Topic** | **Hours/Lectures** |
|  | **January** | Auditing and its types, Energy audits-energy conservations | 1 |
| Provision of energy conservation Act, 2001 | 1 |
| Energy Intensive industries and other establishments | 1 |
| Physical and operational data for the facility | 1 |
|  | **February** | Energy audit procedure, and safety considerations with some case studies | 2 |
| Safety checklists, conducting the audit visit in industries | 1 |
| Primary identification of energy conservation opportunities | 1 |
|  | **March** | Post-audit analysis, energy audit report | 1 |
| Energy audit report format | 1 |
| Energy action plan, Enforcement and implementation, objectives and benefits | 2 |
|  | **April** | Institutional designs for renewable energy resources | 2 |
| Green Building concept | 1 |
| Energy conservation at various levels | 1 |

**MEMT -201 (ENVIRONMENTAL ASSESSMENT & MANAGEMENT)**

**(Unit – IV) (Er. Meenakshi Suhag)**

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| --- | --- | --- | --- |
| **S. No** | **Month** | **Hour/ Lecture** | **Topic** |
| **1** | **January** | 01 | Basics of environmental management systems |
| 02 | Environmental management systems in India, ISO\_14000 |
| 01 | Various components of ISO 14000 |
| **2** | **February** | 01 | Basics of Sustainable development |
| 01 | Dimensions of environmental sustainability |
| 01 | Environmental sustainability – sustainability models |
| 01 | Environmental sustainability indicators |
| **3** | **March** | 01 | Sustainability index |
| 01 | Strategies for sustainable development |
| 01 | Traditional knowledge systems for sustainable development |
| 01 | Introduction to environmental law |
| **4** | **April** | 02 | Environmental protection act in India |
| 02 | Role of Judiciary in environmental conservation in India |

**M.Tech. (Energy & Environmental Management) (2nd Semester)**

**(Session: 2014-2015)**

**MEMT -202 (RENEWABLE ENERGY AND TECHNOLOGY)**

**(Unit – I and IV) (Dr. Hardeep Rai Sharma)**

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No** | **Month** | **Topic** | **Hours/ Lectures** |
|  | **January** | Energy alternatives, the solar option | 2 |
| Nuclear option, Nuclear Fission, Nuclear reactors and its working | 2 |
| Tar sands, different methods of extracting oil from Tar sands and oil shale | 2 |
| Tidal energy and Generating methods | 2 |
|  | **February** | Geo-thermal energy | 2 |
| Solar energy : Solar radiations/ spectrum, solar thermal conversion devices | 2 |
| Solar energy : storage, applications, Solar photovoltaic conversion | 2 |
| Wave energy and Ocean thermal energy conversion | 2 |
|  | **March** | Hydroelectric energy, Process, advantages | 2 |
| Biomass energy: Sources of biomass energy | 1 |
| Petroleum plants, Energy plantations | 2 |
| Production of biogas from organic wastes | 2 |
| Recent trends in biodiesel production | 1 |
|  | **April** | Bio- ethanol production, process | 2 |
| Different technologies regarding Bio-ethanol | 2 |
| Advantages and limitations | 1 |
| Lessons from national and international experience | 1 |
| Energy from organic wastes | 2 |

**MEMT -202 (RENEWABLE ENERGY AND TECHNOLOGY)**

**(Unit – II) (Dr. Sandeep Gupta)**

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| --- | --- | --- | --- |
| **S.No** | **Month** | **Topic** | **Hours/ Lectures** |
|  | **January** | Indirect and direct solar energy conversion - introduction and processes | 1 |
| Stand-alone systems and grid-connected systems | 1 |
| Solar PV conversion processes | 1 |
| Energy bands, optical effects of p-n junction | 1 |
|  | **February** | PV cell design - basic concepts | 1 |
| PV cell - designing issues and analysis | 1 |
| PV cell fabrication - concepts and materials | 1 |
| PV cell fabrication methods | 1 |
|  | **March** | PV System design | 1 |
| Solar module encapsulation | 1 |
| Solar power heaters | 1 |
| Wind energy conversation system: structure and components | 1 |
|  | **April** | Wind energy conversation process | 1 |
| Wind energy converters | 1 |
| Wind energy storage and transfer | 1 |
| Commercial wind power  development | 1 |

**MEMT -202 (RENEWABLE ENERGY AND TECHNOLOGY)**

**(Unit – III) (Dr. Aswani Sharma)**

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| --- | --- | --- | --- |
| **S. No** | **Month** | **Hour/ Lecture** | **Topic** |
| **1** | **January** | 01 | Renewable and non-renewable sources of energy, its types |
| 01 | Sun-Earth complex system, solar flux, spectrum, solar constant |
| 01 | Weins displacement law, Stefan-Boltzman law, black body radiation etc |
| 01 | Solar energy conversions, photovoltaic conversions, thermal conversions |
| **2** | **February** | 01 | Industrial process heat, generation, applications |
| 01 | Temperature requirement, regimes, optimum temperature, consumption pattern |
| 01 | Designing of thermal heat storage, basic designing concept, transport of energy |
| 01 | Types of solar collection systems, concentrating solar collector system |
| **3** | **March** | 01 | Industrial applications of concentrating collector, efficiency, advantages, concerns |
| 01 | Introduction of energy collectors, its types, key criteria, applications |
| 01 | Basic designing of solar collectors, latest installed examples |
| 01 | Basic designing of tracking systems, latest installed examples |
| **4** | **April** | 01 | Basic concept of energy concentrators, types etc |
| 01 | Industrial application of energy concentrators, designing, examples |
| 01 | Scenario of solar heat-thermal potential in India |
| 01 | Case studies on real-time application of solar thermal conversions, industrial process heat etc |

**M.Tech. (Energy & Environmental Management) (2nd Semester)**

**(Session: 2014-2015)**

**MEMT -203 (ENVIRONMENTAL REMOTE SENSING AND GIS)**

**(Unit – I) (Mrs. Pooja)**

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| **Sr. No** | **Month** | **Hours/ Lectures** | **Topic** |
|  | **January** | 01 | Introduction to remote sensing |
| 01 | Physical Basis of remote sensing |
| 01 | Electromagnetic spectrum and radiations |
| 01 | Black body concept and Radiation laws |
|  | **February** | 01 | Energy interaction with atmosphere: Scattering, absorption, refraction |
| 01 | Types and causes of scattering |
| 01 | Atmospheric windows and their significance |
| 01 | Energy interaction with earth surface features: Reflection, Transmission, Absorption |
|  | **March** | 01 | Spectral reflectance and spectral signatures |
| 01 | Types of remote sensing satellites |
| 01 | Characteristics of sensors |
| 01 | Scanning mechanisms |
|  | **April** | 01 | Types of Remote Sensing |
| 01 | Basic principles of global positioning system |
| 01 | Basic concept of GIS |
| 01 | Components and basic process of GIS |

**MEMT -203 (ENVIRONMENTAL REMOTE SENSING AND GIS)**

**(Unit – II) (Ms. Shivani)**

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| --- | --- | --- | --- |
| **S. No** | **Month** | **Topic** | **Hours/ Lectures** |
|  | **January** | Remote Sensing processes - Concepts and Applications | 2 |
| Calibration techniques | 1 |
| Platforms used in Remote Sensing - Space-borne, Air-borne and Terrestrial | 1 |
|  | **February** | Sensors used in Remote Sensing - classification and popular sensors used in missions | 1 |
| Systems for data collection - concepts, systems for weather, land and marine observation | 1 |
| Passive Remote Sensing - concepts, types and applications | 1 |
| Active Remote Sensing - concepts, types and applications | 1 |
|  | **March** | Microwave Remote Sensing - principles, properties, formats | 2 |
| Microwave Remote Sensing - interpretations, SAR, applications | 1 |
| Multispectral Remote Sensing - concepts and applications | 1 |
|  | **April** | LiDAR Remote sensing - principles, ALS components and processes | 2 |
| LiDAR system characteristics, data properties and formats, applications | 2 |

**MEMT -203 (ENVIRONMENTAL REMOTE SENSING AND GIS)**

**(Unit – III & IV) (Dr. Sandeep Gupta)**

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| **S. No** | **Month** | **Topic** | **Hours/ Lectures** |
|  | **January** | Visual image interpretation techniques - introduction, error estimation | 1 |
| Elements of visual image interpretation | 1 |
| Image rectification | 1 |
| Digital image processing - Basic concepts, rectification | 1 |
| Image pre-processing - registration and image enhancement techniques | 1 |
| Image transformation - PCA, fusion, band ratioing | 1 |
| Digital image classification - introduction, unsupervised classification | 1 |
| Digital image supervised classification | 1 |
|  | **February** | Digital image classification procedure,  map accuracy | 1 |
| Geo-referencing, Ground truthing | 1 |
| Photogrammetry: Basic concepts | 1 |
| Aerial Photographs - characteristics and types | 1 |
| Geometric properties of the camera, advantages and disadvantages | 1 |
| Orthophotos, Parallex, Height estimation approaches | 1 |
| Application of Remote Sensing in Energy and natural resource management | 1 |
| Remote Sensing application in environmental management, Disaster management | 1 |
|  | **March** | Application of Remote Sensing in  urban planning and other areas | 1 |
| Data structure: Raster and Grid data | 1 |
| Analytical modeling in GIS- basic concepts | 1 |
| Tools and techniques used in analytical modelling | 1 |
| GIS project - Introduction, databases | 1 |
| GIS project - Problem identification and processes involved | 1 |
| GIS project design | 1 |
| GIS project implementation | 1 |
|  | **April** | GIS project evaluation and analysis | 1 |
| GIS project management, spatial database management systems | 1 |
| Application of GIS in natural resource management | 1 |
| GIS applications in biodiversity and gap analysis | 1 |
| Application of GIS in Environmental  impact assessment | 1 |
| GIS applications in solid waste management | 1 |
| Application of GIS in disaster management | 2 |

**M.Tech. (Energy & Environmental Management) (2nd Semester)**

**(Session: 2014-2015)**

**MEMT -204 (ENVIRONMENTAL BIOTECHNOLOGY AND BIOFUELS)**

**(Unit – I) (Prof. Smita Chaudhry)**

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| --- | --- | --- | --- |
| **Sr. No** | **Month** | **Hours/ Lectures** | **Topic** |
|  | **January** | 01 | Types of Xenobiotics and their sources |
| 01 | Microbes and environmental management |
| 01 | Role of microbes in biodegradation |
| 01 | Biodegradation of macromolecules and xenobiotics |
|  | **February** | 01 | Recalcitrance of Xenobiotics |
| 01 | Biodegradation pathways of xenobiotics |
| 01 | Cometabolism |
| 01 | Biodegradation of toxic organic pollutants by aerobic process |
|  | **March** | 01 | Biodegradation of toxic organic pollutants by Anaerobic process |
| 01 | Biodegradation of toxic organic pollutants by Anoxic biological processes |
| 01 | Biosensors in detection of Environmental Pollution |
| 01 | Biosensor for BOD detection |
|  | **April** | 01 | Methane biosensor |
| 01 | Ammonia and nitrate biosensor |
| 01 | Types of bioreactors |
| 01 | Environmental applications of Bioreactors |

**MEMT -204 (ENVIRONMENTAL BIOTECHNOLOGY AND BIOFUELS)**

**(Unit – II & III) (Dr. Ashwani Sharma)**

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| --- | --- | --- | --- |
| **S. No** | **Month** | **Hour/ Lecture** | **Topic** |
|  | **January** | 01 | Concept of biodegradation, bioremediation and Phytoremediation |
| 01 | Microbes and their environment, types of microbes, basic metabolism, biomass etc |
| 01 | Bioremediation, its types, techniques, natural attenuation, biostimulation and augmentations |
| 01 | Different types of bioremediation, in situ, ex sity, aerobic and anaerobic bioremediation |
| 01 | Heavy metals and types, management of heavy metal contamination, role of microbes, plants, remediation techniques |
| 01 | Bioremediation of oil sludge, examples, oleophilic fertilizers |
| 01 | Oil slicks, oil eating microbes, earlier work, current research in the field |
| 01 | Difference of reserve and resource, concpt of resource recovery |
|  | **February** | 01 | Biosorption and Bioaccumulation techniques, applications, limitations |
| 01 | Bioleaching and Biomining for recovery of resources, large industrial scale application, copper recovery case study (US) |
| 01 | Basic concept and techniques of plant tissue culture, concept of ex-plant |
| 01 | Plant tissue culture in details, somaclonal variations, somatic cells, hybrids |
| 01 | Application of micro-propagation techniques in propagation of trees/ forests, current research, examples etc |
| 01 | Threatened species (Endangered, vulnerable rare) conservation of endangered species |
| 01 | Role of Biotechnology in preservation of bio-diversity |
| 01 | In situ and ex situ conservation, examples, Gene banks, seed banks uses etc |
|  | **March** | 01 | Waste water and its characteristics, treatment of waste water, severage and sevage water |
| 01 | Activated sludge process, primary and secondary treatment, role of microbes, biomass etc |
| 01 | Biological processing of waste water and application of microbial biomass technology, BOD reduction |
| 01 | Application of biotechnology in waste management, examples |
| 01 | Use and application of novel biotechnological principles in solid waste management |
| 01 | Use and application of novel biotechnological principles in hazardous waste management |
| 01 | Use and application of novel biotechnological principles in solid radioactive waste management |
| 01 | Biopolymer, biodegradable plastics |
|  | **April** | 01 | Environment management of degraded ecosystems |
| 01 | Application of biotechnological process in wasteland management, microbial introduction techniques |
| 01 | Biofertilizers introduction and its types, examples |
| 01 | Application of Biofertilizers with examples |
| 01 | Concept of pesticides, insecticides, its types, based on functional groups and mode of action |
| 01 | Biopesticides, examples, application |
| 01 | Genetically modified organisms (GMOs), development, issues, release, regulatory framework |
| 01 | Biosafety guidelines, Intellectual property right, issues and environment |

**MEMT -204 (ENVIRONMENTAL BIOTECHNOLOGY AND BIOFUELS)**

**(Unit – IV) (Er. Meenakshi Suhag)**

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| --- | --- | --- | --- |
| **S. No** | **Month** | **Hour/ Lecture** | **Topic** |
| **1** | **January** | 01 | Biofuels: Biodiesel fuels |
| 01 | Origin of biofuels |
| 01 | Chemical and physical properties of biofuels |
| 01 | Biodiesel production |
| **2** | **February** | 01 | Advantages and disadvantages of biodiesel |
| 01 | Storage and use of biodiesel |
| 01 | Biorefinery concept |
| 01 | Biomass derived chemical products |
| **3** | **March** | 01 | Biomass gasification |
| 01 | Types of gasifiers |
| 02 | Policy issues in biofuels |
| **4** | **April** | 02 | Indian biofuel programme |
| 02 | Bioethanol production |