

**SYLLABUS OF MASTER OF TECHNOLOGY  
ENERGY SCIENCE & TECHNOLOGY**

**First Semester**

**Category – Departmental / Specialization Basket**

**Paper – I**

**PG/EST/T/111A**

**Energy Resources**

Energy and Development, Units and Measurements, Conventional and Non-Conventional Sources of Energy, Fossil and Mineral Energy Resources, Details of Coal, Peat, Oil, Natural Gas and Nuclear Resources, Recovery of Fossil Fuels, Classification and Characterization of Fossil fuels, Basic of Solar, Wind, Bio, Hydro, Tidal, Ocean Thermal and other Renewable Energy Sources, Impact of Energy on Environment, Flow of Energy in Ecological System, Environmental Degradation due to energy, Control of Pollution from Energy.

**Paper- II**

**PG/EST/T/112A**

**Energy Conversion Systems I**

Energy, Conversion routes, Direct and indirect way of Energy Conversion, Principles of heat and mass transfer, Thermodynamics, Fluid static and dynamics, Electricity generation, distribution and use, Basic of Solar Thermal Conversion, Technology of Selective Coating, Fundamentals of Flat Plate Collector and Evacuated Collector, Basic of Wind Energy Conversion, Wind machine, Wind electric generator, Wind pump.

**Paper-III**

**PG/EST/T/113A**

**Energy Conversion Systems II**

Basics of Photovoltaic Conversion technology and PV systems, PV system design methodologies, Basics of Bio-energy conversion, biomethanation technology, Thermochemical Conversion through Pyrolysis, Gasification and Esterification, Bio Oil, Application of Ocean Thermal Gradient and Geothermal gradient for power generation, Basics of hydropower, Tidal and Wave power, Basics of Hydrogen fuel, Fundamentals of Fuel Cells, Basics of Fusion power, Energy Storage Technologies, Mechanical storage, Chemical storage and Electrical storage, Details of Pb-acid battery, Ni-Cd-alkaline battery, Ni-iron and Na-S batteries, battery maintenance and safety precautions.

**Category – Inter Disciplinary Basket**

**Paper – IV**

**PG/EST/T/114A**

**Energy Management**

Fundamental of Energy conservation, Energy Management and Audit, Basics of Energy Demand and Supply, Principles of Economic analysis in the Energy Management and Audit Programme, Supply side and demand side energy management, Boilers and Firing System, Steam, Condensation Systems, Energy Conservation and Management in power plant, Energy conservation in Buildings, Heating, Ventilation and Air Conditioning System, Degree day in energy use monitoring, Energy Conservation Opportunities, in chemical industries, Waste heat recovery, Co-generation, Energy Conservation in Agricultural Sector, Energy conservation in

illumination engineering, Combustion stoichiometry, air-fuel ratio, optimum loading in boilers, etc.

**Paper-V**

**PG/EST/T/115A**

**Industrial Energy Analysis**

Materials and energy balance in the industries, Products and the process, industrial demand and supply networking, Optimization techniques, efficiency analysis, methods, Energy monitoring and ongoing information dissertation in terms of energy consumption, production and cumulative sum of differences. Energy efficiency analysis in various conversion systems like boilers, furnaces, compression systems, controlling systems, etc. Case studies for large scale, medium scale and small scale industries, efficiency integration methodologies.

**Paper –VI**

**PG/EST/T/115A**

**Power Systems Engineering**

Basic concept of power plants, types of power plants, thermal power stations, various components of thermal power stations, power plant cycles, fuel handling, combustion, waste disposal methodologies, economizers, turbo alternators, heat balance and efficiencies, hydroelectric power plant, various components, capacity calculation, design methodologies, operation and maintenance methodologies, elements of nuclear power stations, reactor design, fuel, moderator, coolant control and safety, waste disposal.

**Category – Sessional courses**

**Sessional 1**

**PG/EST/S/111**

**Laboratory**

**Sessional 2**

**PG/EST/S/112**

**Seminar**

**Second Semester**

**Category – Departmental / Specialization Basket**

**Paper – VII**

**PG/EST/T/127A**

**Advanced Energy Management**

Details of Energy management programme in industrial sector, Domestic sector, Agricultural and Transport sectors. Analysis of energy utilization in boiler and firing system. Conversion through heat exchangers, Principle of co-generation, Principle of waste heat recovery, evaluation of energy conservation through thermal insulation, optimization technique in thermal insulation, Commercial options in waste heat recovery. Evaluation of heat loss and heat gain in buildings systems, thermal design building systems, evaluation of window and glazing, solar simulation of building systems, Methods of improving thermal equality. Estimation on energy saving at the industrial houses, Energy budget. Estimation of energy loss in Electrical utilities. Electrical load management. Preparation of project report on Energy Management and audit.

## **Paper – VIII**

### **PG/EST/T/128A**

### **Photovoltaic Energy Systems**

Materials for photovoltaic conversions, Si and non-Si materials, crystalline, semi crystalline, polycrystalline and amorphous materials. Technology for Si extraction, purification, Method of doping and junction fabrication. Cell fabrication and metallisation techniques. Networking the PV cell. Characterization of PV generators, Technology for the fabrication of thin film cells. Optical concentration. Effect of temperature on cell performance, Thermo photovoltaic effect, Solar simulator, Testing and performance assessment of PV generator. Balance of system solar PV generators, Electronic control and regulation. Power conditioning, Converters and Inverters. Concentrating system. System design and configuration. Application of PV for lighting, water pumping. Refrigeration, Telecommunication, Cathodic protection, etc. PV Power Plant Hybridisation Engineering, hybrid systems, Grid integration, Building Integrated PV systems.

### **PG/EST/T/128B**

### **Solar Thermal Energy systems**

Basic of thermal sciences, Methodologies for Solar Thermal Conversion System, Solar Thermal Conversion Coating, Coating technology, General description of solar thermal collectors – Flat plate collectors, Concentrating collectors, Evacuated collector, Analytical design of various types of solar collectors, Performance of solar collectors, ASHRAE code Solar Active and Passive heating, Solar cooling, Conversion to mechanical energy, Solar desalination, Solar drying, Industrial application, etc. Solar Head, Solar Energy storage, Solar Thermal power plant, Economics of solar processes, Modelling of solar thermal systems, Components and simulations, Design and Sizing of solar heating systems.

## **Paper – IX**

### **PG/EST/T/129A**

### **Bio Energy systems**

Biomass resource assessment, properties of biomass, different energy conversion methods-combustion, gasification, pyrolysis, liquification, biomass pre-treatment and processing, Biomethanation technology, case studies, bio diesel, improved wood stove, bio-hydrogen generation, electricity generation from biomass gasifier, engine systems, petrol, diesel and duel fuel engine.

### **PG/EST/T/129B**

### **Wind Energy Systems**

Analysis of wind regimes – statistical analysis of wind regimes, Dynamic data acquisition, Time distribution, Frequency distribution. Statistical modelling, Wind Energy conversion principles, General introduction, types and classification of WECS, Power, Torque Speed Characteristics, maximum power coefficient, wind velocity measuring instrument, factors effecting the wind energy output, Principles of wind pump, Performance analysis of wind pump, Design concept, Testing, Principles of wind electric generators, classification, Basic characteristics of Electric generators, variable and constant speed machines, Mechanical considerations and speed coupling, WECS applications, Stand alone, grid connected and wind farms, WECS systems – Grid interconnection and associated instrumentation, System stability, grid penetration, Aerodynamic design principles, aerodynamic theories, Axial momentum, Blade element and

combined theory, Rotor characteristics, Design of wind turbines- wind turbine design considerations, methodology, theoretical simulation of turbine loss, modelling of wind turbines and testing methods. Mechanical systems – mechanical and hydrochemical power transmission system, Aerodynamic and Mechanical Breaking, mechanisms and control. Dynamics of large wind turbine systems and associated instrumentation and control. Economics of wind energy utilization

### **Category- Inter-Disciplinary Basket**

#### **Paper-X**

#### **PG/EST/T/1210A**

#### **Energy and Environmental Impact Analysis**

Energy, Environment & Climate, Impact of Emission on Environment & Climate, Sources of emission, Types of Emissions from various sectors like industry ,power, human activities, gricultural activities, emission estimation methodologies, Co-relation between Emission and Pollution, Kyoto Protocol, Clean development mechanism, Concepts of Carbon credit, Waste & Effluent and their methodologies for, Air and Water Pollution Controlling Technologies, Change in local and Global Climate, economics of environment ,security for environment, environment modeling development and environment.

#### **Category-Sessional Courses**

#### **Sessional 1**

#### **PG/EST/S/121/ Term Paper Leading To Thesis**

#### **Sessional 2**

#### **PG/EST/S/122 Seminar**

### **Third and Fourth Semester**

#### **Sessional 1**

#### **PG/EST/TH/21 Thesis Work**

#### **Sessional 2**

#### **PG/EST/VV/22 Viva-Voice**