

## **RENEWABLE & NON CONVENTIONAL ENERGY**

**EE-704 D**

**Credit: 3**

**Contact: 3L**

### **Module 1**

#### **Introduction to Energy sources:**

Renewable and non-renewable energy sources, energy consumption as a measure of Nation's development; strategy for meeting the future energy requirements Global and National scenarios, Prospects of renewable energy sources. Impact of renewable energy generation on environment, Kyoto Protocol. [03]

### **Module 2**

#### **Solar Energy:**

Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors, Solar air heaters-types, solar driers, storage of solar energy-thermal storage, solar pond , solar water heaters, solar distillation, solar still, solar cooker, solar heating & cooling of buildings, photo voltaics - solar cells, different types of PV Cells, Mono-poly Crystalline and amorphous Silicon solar cells. Design of PV array. Efficiency and cost of PV systems & its applications. PV hybrid systems. [08]

### **Module 3**

#### **Wind Energy:**

Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations [05]

### **Module 4**

#### **Energy from Biomass:**

Biomass conversion technologies, Biogas generation plants, classification, advantages and disadvantages, constructional details, site selection, digester design consideration, filling a digester for starting, maintaining biogas production, Fuel properties of bio gas, utilization of biogas [05]

### **Module 5**

#### **Geothermal Energy:**

Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India. [05]

### **Module 6**

#### **Energy from Ocean:**

Ocean Thermal Electric Conversion (OTEC) systems like open cycle, closed cycle, Hybrid cycle, prospects of OTEC in India. Energy from tides, basic principle of tidal power, single basin and double basin tidal power plants, advantages, limitation and scope of tidal energy. Wave energy and power from wave, wave energy conversion devices, advantages and disadvantages of wave energy. [05]

### **Module 7**

#### **Magneto Hydrodynamic power generation:**

Principle of MHD power generation, MHD system, Design problems and developments, gas conductivity, materials for MHD generators and future prospects. [03]

### **Module 8**

#### **Hydrogen Energy:**

Introduction, Hydrogen Production methods, Hydrogen storage, hydrogen transportation, utilization of hydrogen gas, hydrogen as alternative fuel for vehicles. [03]

### **Module 9**

#### **Fuel cell:**

Introduction, Design principle and operation of fuel cell, Types of fuel cells, conversion efficiency of fuel cell, application of fuel cells [03]

**Numerical problems to be solved in the class.**

**Text Books:**

4. Non conventional Energy sources, G.D. Rai, Khanna Publishers.
5. Renewable energy sources and conversion technology, Bansal Keemann, Meliss, Tata Mc Graw Hill.
6. Non conventional Energy, Ashok V. Desai, New Age International Publishers Ltd.

**Reference Books:**

1. Renewable energy resources and emerging technologies, D.P. Kothari, Prentice Hall of India Pvt. Ltd.