Course Name Renewable and Non-conventional Energy

Course Code EE605A

Course Credit 3

Contact Hour 3L

Prerequisite

Course Objective

The objectives of this course is understand need of these sources due to crisis of conventional sources and the familiarize with non conventional sources

Course Outcome

On completion of the course students will be able to

1. Explain renewable energy sources & systems.
2. Apply engineering techniques to build solar, wind, tidal, geothermal, biofuel, fuel cell, Hydrogen and sterling engine.
3. Analyze and evaluate the implication of renewable energy. Concepts in solving numerical problems pertaining to solar radiation geometry and wind energy systems.
4. Demonstrate self -learning capability to design & establish renewable energy systems.
5. Conduct experiments to assess the performance of solar PV, solar thermal and biodiesel systems

CO Mapping with departmental POs

H: High, M: Medium, L: Low

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	H	H	H			L	M	L	M	H		
CO 2	H	H	M									
CO 3	H	M	L	M	L			L		M		
CO 4	H				L	L	L		M			
CO 5	H					L	M	M	H	H		

Course Content

Module I: Introduction to Energy sources **3L**

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.

Module II: Solar Energy **8L**

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 voltaic - 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.

Module III: Wind Energy **5L**

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.

Module IV: Fuel cell **3L**

Introduction, Design principle and operation of fuel cell, Types of fuel cells, conversion efficiency of fuel cell, application of fuel cells.

Module V: Energy from Biomass **5L**

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.

Module VI: Geothermal Energy **5L**

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.

Module VII: Energy from Ocean **5L**

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.

Module VIII: Magneto Hydrodynamic power generations **3L**

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

Module IX: Hydrogen Energy **3L**

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

Text Books:

1. Non conventional Energy sources, G.D. Rai, Khanna Publishers.
2. Renewable energy sources and conversion technology, Bansal Keemann, Meliss, Tata Mc Graw Hill.
3. 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.