

## **EE 504: RENEWABLE & DISTRIBUTED ENERGY SYSTEMS (3-0-0: 3)**

### **Energy Resources**

World energy resources, Indian energy scenario, environmental aspects of energy utilization, renewable energy resources and their importance.

### **Solar Energy**

Availability of solar energy, nature of solar energy, solar cell energy conversion, efficiency, characteristics, effect of variation of solar insolation and temperature, losses, components of PV systems, solar PV power plants, photo thermal systems, F chart method,  $\phi$ -F chart method, utilizability modeling & simulation of solar energy systems, life cycle analysis of solar energy system.

### **Wind Energy**

Wind resource assessment, power conversion technologies, wind power estimation techniques, principles of aerodynamics of wind turbine blade, wind mechanics, power content, class of wind turbines, various aspects of wind turbine design, wind turbine generators: induction, synchronous machine, constant V & f and variable V & f generations.

### **Bio-Mass, Bio-Gas, Tide and Wave Energies**

Basic concepts and principles of operation

### **Hydrogen Energy**

Hydrogen as a renewable energy source, sources of hydrogen, fuel for vehicles.

### **Hydel Energy**

Classification of hydel plants, concept of micro hydel, MHP plants: components, design and layout, turbines, efficiency, status in India

### **Nuclear Energy**

International nuclear energy policies and regulations, nuclear energy technologies -fuel enrichment, different types of nuclear reactors, nuclear waste disposal, and nuclear fusion.

### **Distributed Generation Systems**

Benefits and limitations; classification of small generating systems, electric equivalent circuits of fuel cells, solar cells, micro-turbines, reciprocating engines, wind turbines and gas turbines, effects of renewable energy into the grid, supply guarantee, power quality, stability, intentional and unintentional islanding, power converter topologies for grid interconnection, inverter modelling, control of grid interactive power converters, synchronization and phase locking techniques, current control, and recent trends in DG interconnection.

### **Text Books & References**

1. Andrews J, Jelley N, "Energy Science", Oxford University Press, 2010
2. Fang Lin Luo, Hong Ye, "Renewable Energy Systems: Advanced Conversion Technologies and Applications", CRC Press, Taylor & Francis Group.
3. H Lee Willis, Walter G Scott "Distributed Power Generation, Planning & Evaluation", CRC Press Taylor & Francis Group.
4. Remus Teodorescu, Marco Liserre, Pedro Rodríguez, "Grid Converters for Photovoltaic and Wind Power Systems", John Wiley & Son
5. B H Khan, "Non-Conventional Energy Resources", Tata McGraw-Hill Education.