

## SMART ELECTRICAL ENERGY SYSTEM

### Module- I (7 Hrs)

Non-renewable reserves and resources; renewable resources, Transformation of Energy. Solar Power: Solar processes and spectral composition of solar radiation; Radiation flux at the Earth's surface. Solar collectors. Types and performance characteristics. Applications.

*SOLAR THERMAL SYSTEM*: Solar Collection Devices; their analysis; Solar Collector Characteristics; Solar Pond; application of solar energy to space heating etc.

### Module- II (8 Hrs)

Wind Energy: Wind energy conversion; efficiency limit for wind energy conversion, types of converters, aerodynamics of wind rotors, power - speed and torque - speed characteristics of wind turbines, wind turbine control systems; conversion to electrical power: induction and synchronous generators, grid connected and self excited induction generator operation, constant voltage and constant frequency generation with power electronic control, single and double output systems, reactive power compensation

### Module- III (15 Hrs)

#### Distributed Generation

Standards, DG potential, Definitions and terminologies; current status and future trends, Technical and economical impacts, Definitions and terminologies; current status and future trends, Technical and economical impacts

DG Technologies, DG from renewable energy sources, DG from non-renewable energy sources, Distributed generation applications, Operating Modes, Base load; peaking; peak shaving and emergency power, Isolated, momentary parallel and grid connection

Distribution system performance and operation

Distribution automation and control, Voltage drop calculation for distribution networks, Power loss Calculation, Application of capacitors to distribution systems, Application of voltage regulators to distribution systems

### Module- IV (15 Hrs)

Introduction to smart grid:

Introduction to the smart grid, including objectives and functions, views of the smart grid with in the industry, and design criteria.

### **BOOKS RECOMMENDED :**

1. S. N. Bhadra, D. Kastha, S. Banerjee, *Wind Electrical Systems*: Oxford Univ. Press, 2005.
2. S.A. Abbasi, N. Abbasi, *Renewable Energy Sources and Their Environmental Impact*: Prentice Hall of India, 2004.
3. S.P. Sukhatme - *Solar Energy: Principles of thermal Collection and Storage*, TMH, New Delhi
4. H.P. Garg and Jai Prakash - *Solar Energy: Fundamentals and Applications*, TMH
5. 5.Ned Mohan et. al : *Power Electronics* ,John Wiley and Sons
6. 6.P C Sen : *Power Electronics* , TMH
7. G K Dubey et. al : *Thyristorised Power Controllers* , Wiley Eastern Ltd.
8. B K Bose : *Modern Power Electronics and AC Drives*, Pearson Edn (Asia)