

N.B.

1. Question No.1 is Compulsory.
2. Answer any three out of remaining five questions
3. Assume any suitable data wherever required, justify the same
4. Illustrate answer with sketches wherever required

- Q 1 a) Discuss two power quality issues and two protection issues of the solar PV system **05**
- b) List out the solar PV technologies. Illustrate anyone in brief. **05**
- c) Compare Horizontal Axis Wind Technology and Vertical Axis Wind Turbine **05**
- d) What are the different ways to use solar thermal energy? Describe any one of them in brief with the help of neat diagram. **05**
- Q 2 a) Describe the principle of operation of Proton Exchange Membrane Fuel Cell (PEMFC) along with its electrical characteristics. Illustrate how PEMFC can fed power to three phase AC standalone load. **10**
- b) Illustrate the financial benefits of energy storage systems in detail. **10**
- Q 3 a) Explain the principle of pumped hydro storage system and their importance **10**
- b) Draw the power topology of wind energy system based on doubly fed induction generator **10**
- Q 4 a) Draw I-V (current v/s voltage) and P-V (power v/s voltage) characteristics of a solar PV cell and clearly mark all essential parameters on it. What is the impact of change in solar radiation and temperature on solar PV characteristics? **10**
- b) Explain the working of a Wind Energy System (WES) with its various components. What are the different power converter topologies used for WES? Explain anyone in detail. **10**
- Q 5 a) State and explain following parameters related to batteries: **10**
- i) State of charge (SOC)
  - ii) Depth of discharge (DOD)
  - iii) Battery Capacity
  - iv) C-Rating
- b) Illustrate the principle of Aerodynamics in relation with Wind turbine operation **05**
- c) Illustrate the phenomenon of Hot Spots in PV module. **05**
- Q 6 Write short notes on:
- a) Compare various solar PV technology Mono crystalline, poly crystalline and thin film (08) **08**
  - b) Flywheel as an energy storage device **05**
  - c) What is MPPT in solar system? Explain anyone MPPT algorithm. Also explain distributed MPPT **07**