(3 Hours) **[Total Marks: 80]**

N.B.

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

Q 1	a	Explain BOS (Balance of System) of solar PV system in brief	**05**
	b	Comment on the world's production and reserves of Fossil fuels. Also state the commercial energy production using renewable energy sources in India.	**05**
	c	Explain the terms 'distributed generation (DG)' and 'Hybrid DG (HDG)'. What are the challenges towards integrating the DG / HDG with the grid? What are the means of mitigating these challenges?	**05**
	d	Explain in brief, the use of Ultra-capacitor as the energy storage element in any of the two applications.	**05**
Q 2	a	Describe the working principle of Wind Energy System (WES) with its various components. What are the different power converter circuits used for WES power processing? Explain any one of them in detail.	**10**
	b	What are different types of solar thermal systems used in practice? How electrical power can be generated using solar thermal systems?	**10**
Q 3	a	Explain the principles of **any two** of the following power generation systems. i) Tidal energy ii) Biomass energy iii) Micro-hydro	**10**
	b	Explain the principle of Geothermal energy conversion. Write its advantage and disadvantage.	**10**
Q 4	a	Describe various energy storage elements which are commonly used in combination with renewable energy system and compare their performance.	**10**
	b	Draw a typical schematic of power topology used to extract power from PEM (Proton Exchange Membrane) Fuel cell and explain the operation in standalone mode and grid connected mode.	**10**
Q 5	a	Compare mono-crystalline, poly-crystalline and thin film solar PV technology. Also state the effect of the following on Solar PV system performance (i) Mismatch in modules (ii) Hot spots in the modules.	**10**
	b	Compare Fuel cell-based power generation, with WES power generation and solar PV based power generation.	**10**
Q 6	a	Explain the use of battery banks in electric vehicle and power system applications	**10**
	b	Draw a typical schematic of power topology used to extract power from Solar PV and explain the operation in standalone mode and grid connected mode.	**10**

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