(3Hrs) **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 required but justified the same
4. Illustrate answer with sketches wherever required

Q 1		**Attempt any FOUR**	
	a)	Illustrate the application of flywheel as an energy storage device.	**(05)**
	b)	Illustrate the operation of seasonal thermal energy storage.	**(05)**
	c)	Illustrate the energy storage process in pressurized gas.	**(05)**
	d)	Explain the V2X mode of operation of an electric vehicle.	**(05)**
	e)	Justify the necessity of an energy storage in electrical power system.	**(05)**
Q 2	a)	Draw the schematic of superconducting magnetic energy storage (SMES) and also, elaborate it's working.	**(10)**
	b)	Compare the performance of super capacitor as an energy storage device over a capacitor	**(10)**
Q 3	a)	Explain the working of pumped hydro energy storage technology also mention its advantages, disadvantages, and applications.	**(10)**
	b)	Illustrate in detail, any five energy storage technologies.	**(10)**
Q 4	a)	Draw load curves with and without energy storage system and state the advantages of energy storage devices from load curve point of view.	**(10)**
	b)	Explain any two battery technologies which can be used as an electrochemical energy storage.	**(05)**
	c)	Explain with a neat diagram how energy can be stored and utilized from a solar pond?	**(05)**
Q 5	a)	Illustrate the process of battery sizing for standalone application.	**(10)**
	b)	Illustrate the term "Hybrid Energy Storage System" and its applications.	**(05)**
	c)	Illustrate the principle of operation of fuel cell.	**(05)**
Q 6	a)	Define SoC of energy storage. Illustrate the types SoC estimation techniques.	**(10)**
	b)	What is the necessity of series connection of super capacitor?	**(05)**
	c)	Describe battery system model in brief.	**(05)**

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