

TE Elect-6

E.S. University of Mumbai 31.5.22

1/3 (80)

Examinations Summer 2022
Energy Storage sem -6

40 + 30

Time: 2 hour 30 minutes

93896 Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	Heat energy collected from the sun by solar plate collectors is transferred by transfer medium (air) to Rock bed which absorbs the heat and cooled air is circulated. Name the type of Energy storage system.
Option A:	Latent TES
Option B:	Sensible TES
Option C:	Super-magnetic Energy storage
Option D:	Flywheel energy storage
2.	The typical value of each cell voltage of Nickel metal Hydride battery is-
Option A:	1.35 V
Option B:	4.1 V
Option C:	5 V
Option D:	12 V
3.	Which layer of a solar pond acts as a thermally insulating layer to trap the sun's heat within the solar pond?
Option A:	Upper convective zone
Option B:	Middle non-convective zone
Option C:	Bottom convective zone
Option D:	Surface non-convective zone
4.	The battery charging method which involves charging it at a higher Constant Current for an initial period, lowering the current amplitude as battery voltage increases is -
Option A:	Pulse charging
Option B:	Constant current Constant Voltage charging
Option C:	multi-step CC charging method
Option D:	Reflex charging
5.	_____ stores energy in the magnetic field created by the flow of direct current in a superconducting coil which has been cryogenically cooled to a temperature below its critical temperature.
Option A:	Flywheel ESS
Option B:	Super capacitors
Option C:	SMES
Option D:	Batteries
6.	The battery estimation done to predict the remaining useful life or the remaining charge-discharge cycles, which infers if batteries need to be replaced with new ones is known as-
Option A:	SOC estimation
Option B:	SOH estimation
Option C:	SOS estimation
Option D:	SOT estimation
7.	Determine the energy stored in a Capacitor of capacitance 1200 uF and charge across its plates is 0.4 C?
Option A:	66 J
Option B:	6.67 J

Option C:	1.67 J
Option D:	166 J
8.	For battery application in Electric vehicles, the driving range of a vehicle is roughly proportional to its -----.
Option A:	Specific power density
Option B:	Specific Energy density
Option C:	Depth of discharge
Option D:	Cycle life
9.	The C rate of a battery of capacity 30 kWh if it discharges at the rate of 15 kW in 2 hours is-
Option A:	0.1C
Option B:	2C
Option C:	10C
Option D:	0.5C
10.	What is typically the value of specific energy density of Lithium Ion batteries?
Option A:	35 to 40 Wh/kg
Option B:	10 to 20 Wh/kg
Option C:	300 to 500 Wh/kg
Option D:	150 to 200 Wh/kg

Q2 (20 Marks Each)	
A	Solve any Two 5 marks each
i	Explain the working principle of Flywheel Energy storage system. What factors determine the amount of energy stored in it?
ii	Explain the features and applications of ultra-capacitors.
iii	Explain working of sensible thermal energy storage system.
B	Solve any One 10 marks each
i	Explain with neat diagram the working of Vanadium Redox Flow battery. What are its advantages as compared to conventional batteries?
ii	With neat diagram explain Pumped Hydro Energy Storage system. Give its applications.

Q3 (20 Marks Each)	
A	Solve any Two 5 marks each
i	Explain the necessity of Energy storage.
ii	Explain with neat diagram how energy is stored in (CAES) Compressed Air Energy Storage system.
iii	Explain the types and applications of Fuel Cells?
B	Solve any One 10 marks each
i	With neat diagram explain the construction, working, cell reactions, advantages and applications of Lium-ion batteries.
ii	Explain the following parameters related to Electrochemical batteries- Specific Energy density, C-rate, depth of discharge, Cycle Life and Self- discharge.

Q4 (20 Marks Each)	
A	Solve any Two 5 marks each

i	Explain the V2X, G2V and V2G modes of operation of Electric Vehicles.
ii	What are Solar Ponds? Explain with neat diagram how energy can be stored and utilized from a Solar Pond?
iii	Explain any two methods for battery SOC estimation.
B	Solve any One 10 marks each
i	Explain the configurations and applications of Hybrid Energy Storage Systems (HESS).
ii	Compare the different Energy storage technologies with respect to their storage capacity, Mass and volume energy density, power density, Cycle life, response time, discharge time, cost, Self-discharge and applications.