UNIT–II

Worksheet: Types of Electrical Energy Storage Systems

Part A: Multiple Choice Questions (20 × 1 Mark = 20 Marks)

1. Electrical Energy Storage (EES) systems are commonly classified based on:

a) Cost
b) Voltage rating
c) Form of energy used
d) Color of storage medium

Answer: c) Form of energy used

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2. Which of the following is a mechanical energy storage system?

a) Li-ion Battery
b) Pumped Hydro Storage
c) SMES
d) Hydrogen Storage

Answer: b) Pumped Hydro Storage

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3. Pumped Hydro Storage (PHS) accounts for approximately _____ of worldwide installed electrical storage capacity.

a) 50%
b) 75%
c) 90%
d) 99%

Answer: d) 99%

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4. Typical efficiency of Pumped Hydro Storage is:

a) 30–40%
b) 50–60%
c) 70–85%
d) 95–100%

Answer: c) 70–85%

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5. In CAES, electrical energy is stored in the form of:

a) Heat
b) Chemical bonds
c) Compressed air
d) Magnetic field

Answer: c) Compressed air

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6. A major disadvantage of CAES is:

a) High energy density
b) Geographic limitations
c) Unlimited cycle life
d) High efficiency

Answer: b) Geographic limitations

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7. Flywheel Energy Storage stores energy as:

a) Thermal energy
b) Chemical energy
c) Rotational energy
d) Electrical energy

Answer: c) Rotational energy

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8. Advanced flywheels use:

a) Wooden rotors
b) Carbon fiber rotors and magnetic bearings
c) Copper rotors
d) Iron cores only

Answer: b) Carbon fiber rotors and magnetic bearings

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9. Which battery technology has been commercially used since about 1890?

a) Li-ion
b) NaS
c) Lead Acid
d) NaNiCl

Answer: c) Lead Acid

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10. Which battery performs well at temperatures between −20°C and −40°C?

a) Lead Acid
b) Lithium-ion
c) Nickel Cadmium
d) Sodium Sulphur

Answer: c) Nickel Cadmium

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11. The nominal voltage of a lithium-ion cell is approximately:

a) 1.2 V
b) 2.0 V
c) 3.7 V
d) 12 V

Answer: c) 3.7 V

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12. Which battery technology is widely used in laptops and smartphones?

a) Lead Acid
b) Lithium-ion
c) NaS
d) Zinc-Air

Answer: b) Lithium-ion

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13. Sodium Sulphur batteries operate at approximately:

a) 25°C
b) 100°C
c) 300–350°C
d) 700°C

Answer: c) 300–350°C

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14. The ZEBRA battery is another name for:

a) Li-ion Battery
b) Lead Acid Battery
c) Sodium Nickel Chloride Battery
d) Zinc-Air Battery

Answer: c) Sodium Nickel Chloride Battery

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15. In a Redox Flow Battery, energy is stored in:

a) Rotating mass
b) Magnetic field
c) Liquid electrolytes
d) Molten salts

Answer: c) Liquid electrolytes

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16. Which flow battery is the most developed and widely studied?

a) Fe-Ti Battery
b) Zn-Br Battery
c) Vanadium Redox Flow Battery
d) Fe-Cr Battery

Answer: c) Vanadium Redox Flow Battery

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17. Supercapacitors are also known as:

a) Flow Batteries
b) Double-Layer Capacitors
c) Fuel Cells
d) Hybrid Batteries

Answer: b) Double-Layer Capacitors

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18. SMES stores energy in a:

a) Thermal field
b) Chemical bond
c) Magnetic field
d) Hydraulic reservoir

Answer: c) Magnetic field

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19. The typical efficiency of SMES is:

a) 20–30%
b) 40–50%
c) 60–70%
d) 85–90%

Answer: d) 85–90%

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20. Which EES technology is best suited for long-duration storage (days to months)?

a) DLC
b) Flywheel
c) Hydrogen and SNG
d) SMES

Answer: c) Hydrogen and SNG

Part B: Fill in the Blanks (20 × 1 Mark = 20 Marks)

1. Pumped Hydro Storage uses two water reservoirs at different _____.

Answer: elevations

2. During charging in PHS, water is pumped from the _____ reservoir to the upper reservoir.

Answer: lower

3. The efficiency of PHS ranges from _____ to 85%.

Answer: 70%

4. CAES stands for Compressed Air Energy _____.

Answer: Storage

5. Flywheel Energy Storage stores energy in a rotating _____.

Answer: rotor

6. Advanced flywheels may rotate at speeds exceeding _____ rpm.

Answer: 50,000

7. Lead-acid batteries generally achieve cycle efficiencies of _____ to 90%.

Answer: 80%

8. Nickel Cadmium batteries contain the toxic material _____.

Answer: cadmium

9. Lithium-ion batteries typically have efficiencies of _____ to 98%.

Answer: 95%

10. The theoretical specific energy of lithium-air batteries is approximately _____ kWh/kg.

Answer: 11.14

11. Sodium Sulphur batteries use molten sodium and molten _____.

Answer: sulphur

12. The operating temperature of NaNiCl batteries is around _____ °C.

Answer: 270

13. Flow batteries store energy in liquid _____.

Answer: electrolytes

14. The Vanadium Redox Flow Battery is abbreviated as _____.

Answer: VRFB

15. Hydrogen is produced by the _____ of water.

Answer: electrolysis

16. Synthetic Natural Gas is commonly abbreviated as _____.

Answer: SNG

17. Double-layer capacitors are also called _____ capacitors.

Answer: super

18. SMES stands for Superconducting Magnetic Energy _____.

Answer: Storage

19. Thermal storage using phase change materials stores _____ heat.

Answer: latent

20. The most mature large-scale energy storage technology is _____ Hydro Storage.

Answer: Pumped