

Reg No :

Name :

**MAR ATHANASIUS COLLEGE OF ENGINEERING, KOTHAMANGALAM**

(Govt. Aided Autonomous Institution)

Fourth Semester B.Tech. Degree Examination, May, 2026

Course Code: B24EEM43

Course Name: ENERGY STORAGE SYSTEMS

Max. Marks: 100

Duration:3 Hours

PART - A: 30 Marks (10 Qns x 3 Marks)**Answer all questions**

1. Describe the mathematical representation of a energy storage system.
2. Define the term “econometric model” in the context of energy storage.
3. What are the general considerations in designing a thermal energy storage system?
4. Describe the working principle of pumped hydro energy storage.
5. What is the primary function of a capacitor bank in an electrical system?
6. Define an electrochemical fuel cell.
7. Write short notes on applications of solar thermal technologies.
8. Explain why energy storage is more critical in isolated power systems compared to grid-connected systems.
9. How does a microgrid improve energy reliability in a local area?
10. Explain battery SCADA system.

PART - B: 70 Marks (5 Qns x 14 Marks)**Answer any One full question from each module.****Module 1**

11. a. Differentiate between static and dynamic duties of storage plant. (7 Marks)
- b. Explain the concept of ‘Energy transfer duty’. (7 Marks)

OR

12. a. Explain the effect of losses on the energy balance of a storage unit. (7 Marks)
- b. Discuss the importance and applications of energy storage systems in modern power (7 Marks) systems.

Module 2

13. a. Explain the different methods to produce hydrogen. (7 Marks)
b. Discuss the safety challenges of storing hydrogen at high pressure. (7 Marks)

OR

14. a. Discuss the design considerations of a flywheel energy storage system. (7 Marks)
b. Compare flywheel energy storage with battery energy storage based on performance. (7 Marks)

Module 3

15. a. Illustrate the working of a Superconducting magnetic Energy Storage system with a neat block diagram. (10 Marks)
b. Discuss the importance of cryogenic cooling in maintaining superconductivity. (4 Marks)

OR

16. a. Explain the working of Li-ion batteries. Discuss the merits and demerits of Li-ion battery (7 Marks)
b. Compare Li-ion battery and Ni-Cd battery. (7 Marks)

Module 4

17. Describe in detail the working principles of tidal energy and hydroelectric energy systems.

OR

18. Describe the principles of electricity generation from wave and wind energy.

Module 5

19. Explain the meaning of distributed energy storage and outline its major areas of application.

OR

20. a. Illustrate how DC power supplies are used in electric vehicle charging systems within the framework of electromobility. (7 Marks)
b. Discuss the benefits and challenges of V2G technology in promoting sustainable energy systems and EV adoption. (7 Marks)
