Reg. No.												

Question Paper Code	13031

M.E. / M.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2024

Third Semester

M.E. - Power Electronics and Drives

20PPEEL309 - ADVANCED ENERGY STORAGE TECHNOLOGY

Regulations - 2020

Duration: 3 Hours | Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	Recall the importance of energy storage in balancing variations in energy demand.	2	K1	CO1
2.	Interpret two environmental issues associated with energy storage systems.	2	K2	CO1
3.	Infer the primary purpose of using compressed air in potential energy storage systems.	2	K1	CO2
4.	Show why fuel cells are considered as an important technology for sustainable energy storage?	2	K2	CO2
5.	What is meant by the discharge rate of an energy storage system?	2	K1	CO3
6.	What is cycle lifetime of an energy storage system?	2	K1	CO3
7.	Relate hydrogen economy as an important future energy solution.	2	K2	CO4
8.	Identify the main advantage of using a Bacitor in hybrid power generation systems.	2	K2	CO4
9.	Show that reversible reactions significant in battery operations.	2	K2	CO5
10.	Outline two industries where battery storage systems are used for drying and heating processes.	2	K2	CO5

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

			Marks	K – Level	CO
11.	a)	Demonstrate the variations in energy demand and supply impact the design and choice of storage systems.	13	K2	CO1
		OR			
	b)	Summarize the environmental and sustainability challenges in developing large-scale energy storage solutions.	13	K2	CO1
12.	a)	Describe the importance of energy transformations in modern energy storage systems, focusing on how potential and kinetic energy transformations help meet energy demands and support sustainable energy solutions.	13	K2	CO2
		OR			
	b)	Illustrate how various forms of chemical and electrochemical energy	13	K2	CO2

storage (e.g., hydrogen, batteries) contribute to diverse energy needs, including applications in transportation, grid stability, and portable devices.

13.	a) i)	Discuss how energy capture rate and discharge rate impact the overall efficiency of energy storage systems.	*7*	*K2*	*CO3*
	ii)	Explain how scale flexibility and durability influence the choice of energy storage systems for different applications, from residential to industrial.	*6*	*K2*	*CO3*
		OR			
	b) i)	Describe the environmental considerations in selecting energy storage systems, focusing on material availability, recycling potential, and ease of recovery.	*7*	*K2*	*CO3*
	ii)	Compare the merits and demerits of different types of energy storage in terms of safety, toxicity, and environmental impact.	*6*	*K2*	*CO3*
14.	a)	Explain the various hydrogen storage techniques and additionally, outline the properties and power calculations associated with super capacitors, including their operation and design methods.	*13*	*K2*	*CO4*
		OR			
	b)	Describe how Bacitors combined with fuel cells or flow batteries function in hybrid power generation and their use in HEVs and regenerative systems. What are the benefits and challenges?	*13*	*K2*	*CO4*
15.	a)	Develop the role and functions of Battery Management Systems (BMS) in enhancing the performance and safety of battery storage systems. How do BMS solutions differ between lead-acid and lithium-ion batteries?	*13*	*K3*	*CO5*
		OR			
	b)	Identify the applications of battery storage systems in various energy sectors, including waste heat recovery, solar energy storage, and automotive energy solutions for hybrid and electric vehicles.	*13*	*K3*	*CO5*

PART - C (1× 15 = 15 Marks)

16.	a) i)	Explain the chemical and physical storage of hydrogen.	*7*	*K2*	*CO4*
	ii)	Discover waste heat recovery technologies and their importance towards EMS.	*8*	*K4*	*CO5*
		OR			
	b) i)	Summarize briefly on Hybrid Energy Storage.	*7*	*K2*	*CO4*
	ii)	Categorize various Energy Storage Systems for Electric Vehicles.	*8*	*K4*	*CO5*