Reg. No.															

Question Paper Code	14033

M.E. / M.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025

Third Semester

M.E. - Power Electronics and Drives

24PPEEL309 – ADVANCED ENERGY STORAGE TECHNOLOGY

Regulations - 2024

Duration: 3 Hours | Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	Interruption in energy supply can be minimized using storage systems because they: a) Generate additional power continuously b) Act as a backup source during outages c) Reduce the load on renewable sources d) Increase fossil fuel usage	1	K1	CO1
2.	Small-scale portable energy storage is generally required for: a) Mobile electronics and EVs b) Bulk industrial energy demand c) Seasonal energy balancing d) Long-distance transmission support	1	K1	CO1
3.	The main limitation of superconducting magnetic energy storage (SMES) is: a) Slow response time b) High energy density c) Requirement of cryogenic cooling d) Inability to deliver high power	1	K1	CO2
4.	Which of the following is an example of potential energy storage? a) Flywheels b) Pumped hydro c) Molten salts d) Fuel cells	1	K1	CO2
5.	Which energy storage method has very low environmental impact but requires large geographical space? a) Flywheel energy storage b) Pumped hydro storage c) Lithium-ion battery storage d) Supercapacitors	1	K1	CO3
6.	Which of the following is a major demerit of flywheel energy storage systems? a) Low power density b) Risk of mechanical failure at high speed c) Low cycle life d) Toxic material usage	1	K1	CO3
7.	The combination of a Bacitor with a fuel cell or flow battery primarily aims to: a) Increase charging time b) Improve response speed and efficiency of hybrid power systems c) Decrease system voltage d) Eliminate storage units	1	K1	CO4
8.	In hybrid energy storage systems, the role of the supercapacitor is mainly to: a) Store large amounts of energy for long durations b) Provide peak power and handle sudden load changes c) Generate hydrogen d) Convert DC to AC	1	K1	CO4
9.	The main chemical reaction in a Lead-Acid battery involves: a) Zinc and copper electrodes b) Lead and lead dioxide with sulfuric acid electrolyte c) Nickel and cadmium d) Lithium and cobalt oxide	1	K1	CO5
10.	Power storage capacity of a battery is commonly expressed in: a) Amperes b) Volts c) Watt-hours (Wh) or Kilowatt-hours (kWh) d) Coulombs per second	1	K1	CO5

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

11.	List the alternative sources of energy.	2	K1	CO1
12.	Identify the main form of energy storage used in modern power systems.	2	K1	CO1

13.	List the applications of potential energy.		*2*	*K1*	*CO2*
14.	State energy transformations.		*2*	*K1*	*CO2*
15.	Define Autonomy.		*2*	*K1*	*CO3*
16.	List the reasons why batteries are not fully efficient.		*2*	*K1*	*CO3*
17.	Enumerate the uses for flow batteries.		*2*	*K2*	*CO4*
18.	List the advantages and disadvantages of hybrid energy storage.		*2*	*K1*	*CO4*
19.	Define scale flexibility.		*2*	*K1*	*CO4*
20.	State the importance of lead acid batteries.		*2*	*K1*	*CO5*
21.	List the applications of lithium batteries.		*2*	*K1*	*CO5*
22.	Justify why energy storage is important for automotive applications.		*2*	*K2*	*CO5*

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

23.	a)	Describe various types of energy storages with suitable examples.	*11*	*K2*	*CO1*
		OR			
	b)	Describe the impact of energy storage on the environment.	*11*	*K2*	*CO1*
24.	a)	Explain how superconducting magnetic energy storage stores and delivers energy.	*11*	*K2*	*CO2*
		OR			
	b)	Describe in detail the construction, working, and applications of a Pumped Hydro Storage system.	*11*	*K2*	*CO2*
25.	a)	Discuss the importance of cycling capacity in energy storage systems.	*11*	*K2*	*CO3*
		OR			
	b)	Discuss in detail the Characteristics of energy storage techniques.	*11*	*K2*	*CO3*
26.	a)	Explain how the pressurized PEM water electrolysis process flows with a neat sketch.	*11*	*K2*	*CO4*
		OR			
	b)	Explain about Electrochemical double layer super capacitor and its application.	*11*	*K2*	*CO4*
27.	a)	Explain in detail about lead-acid batteries and their applications.	*11*	*K2*	*CO5*
		OR			
	b)	Explain with neat diagram of solar energy storage system.	*11*	*K2*	*CO5*
28.	a) i)	Summarize how regenerative energy storage systems works.	*6*	*K2*	*CO4*
	ii)	Summarize how waste heat recovery systems improve overall efficiency in industries.	*5*	*K2*	*CO5*
		OR			
	b) i)	Describe the dual-mode hybrid electric vehicle in detail.	*6*	*K2*	*CO4*
	ii)	Explain the concept of greenhouse heating and its role in energy storage systems.	*5*	*K2*	*CO5*