Reg. No.																

Question Paper Code	14625

M.E. / M.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2026

Second Semester

M.E. - Power Electronics and Drives

24PPEEL210 - ELECTRIC VEHICLES AND POWER MANAGEMENT

Regulations - 2024

Duration: 3 Hours | Max. Marks: 100

PART – A (i) (MCQ)
(16 × 1 = 16 Marks)
Answer ALL Questions

		Marks	K – Level	CO
1.	What feature in electric vehicles converts kinetic energy generated during braking into electrical energy to recharge the battery? a) Solar panels b) Regenerative braking c) Turbocharger d) Radiator fan	1	K1	CO1
2.	Which component of an electric vehicle cools down the electric motor and other components to prevent overheating during operation? a) Radiator b) Exhaust pipe c) Cooling fan d) Carburetor	1	K1	CO1
3.	Identify the primary source of propulsion in an electric vehicle? a) Gasoline b) Diesel c) Electric motor d) Hydrogen fuel cell	1	K1	CO1
4.	Which of the following storage methods has worked similar to the cycle of a Gas turbine Power plant? a) SMES b) Flywheel c) Pumped Hydroelectric d) Compressed Air Energy Storage	1	K1	CO2
5.	---------- is defined as the fraction or percentage of the capacity which has been removed from the fully charged battery. a) State of charge b) State of health c) Depth of discharge d) self discharge	1	K1	CO2
6.	What is the C-rate of a 15-kWh battery discharging at 30 kW in 30 minutes? (Use C = P(kW)/Q(kWh)) a) 0.1 C b) 0.2 C c) 0.4 C d) 0.3 C	1	K2	CO2
7.	Choose the following factors that affects how far an electric vehicle (EV) can travel on a single charge? a) Battery range b) Engine size c) Fuel efficiency d) Transmission type	1	K2	CO3
8.	Assertion: Induction motors are commonly used in electric vehicles. Reason: Induction motors are cost-effective and require minimal maintenance. a) Both assertion and reason are true, and the reason is a correct explanation of the assertion. b) Both assertion and reason are true, but the reason is NOT a correct explanation of the assertion. c) The assertion is true, but the reason is false. d) The assertion is false, but the reason is true.	1	K2	CO3

9.	Why is a converter used in a DC motor drive system?	*1*	*K1*	*CO3*
	a) To convert DC power to AC power b) To control the armature voltage c) To provide regenerative braking d) To protect the motor from overvoltage			
10.	How do control strategies improve the performance of a parallel hybrid electric drive train?	*1*	*K2*	*CO4*
	a) To determine the vehicle's color b) To regulate tire pressure c) To optimize power distribution between the internal combustion engine (ICE) and the electric motor d) To control the vehicle's steering			
11.	A parallel hybrid electric vehicle is required to achieve fast acceleration for highway merging. What should be the primary consideration when determining the engine power capacity?	*1*	*K3*	*CO4*
	a) To select the vehicle's color b) To optimize the transmission type c) To ensure the battery pack is large enough d) To achieve the desired acceleration and performance			
12.	A parallel hybrid vehicle is designed primarily for highway driving with steady speeds. To improve fuel efficiency, which engine power capacity should be selected?	*1*	*K1*	*CO4*
	a) Higher engine power capacity reduces fuel consumption on highways b) Engine power capacity has no impact on fuel consumption on highways c) Lower engine power capacity generally leads to improved fuel efficiency on highways d) It determines the tire pressure			
13.	In a Z-converter circuit, fluctuations are observed in the output voltage during switching. What is the role of capacitors in addressing this issue?	*1*	*K2*	*CO5*
	a) To regulate the switching frequency b) To store energy and smooth the output voltage c) To control the bidirectional power flow d) To provide isolation to the battery			
14.	During peak electricity demand, an electric vehicle is connected to a charger that supports grid interaction. How does bidirectional charging capability help in this situation?	*1*	*K1*	*CO5*
	a) It allows EVs to charge only from the grid b) . It enables EVs to feed excess power back into the grid c) It restricts the power flow in one direction only d) It ensures faster charging rates			
15.	In a Z-converter, the output voltage shows ripple during switching operation. Which component is responsible for minimizing this ripple and maintaining a stable output?	*1*	*K3*	*CO5*
	a) To provide electrical isolation b) To smooth the output voltage and store energy c) To control the bidirectional power flow d) To regulate the switching frequency			
16.	In a Z-converter connecting two DC sources, direct electrical coupling may cause safety and interference issues. Which method is used within the converter to ensure proper electrical isolation between the sources?	*1*	*K3*	*CO5*
	a) By using a bidirectional diode b) By connecting the sources in parallel c) By using a transformer with high permeability d) By placing a resistor between the sources			

PART – A (ii) (Short Answer Questions)
(8 × 3 = 24 Marks)
Answer ALL Questions

17.		In an electric vehicle where the engine is not mechanically connected to the wheels but only generates electrical power, identify the type of hybrid system is used and how does it operate?	*3*	*K3*	*CO1*
18.		A hybrid electric vehicle has an electric motor rated at 40 kW and a total drivetrain power of 100 kW. How is the hybridization ratio interpreted for this vehicle?	*3*	*K3*	*CO1*
19.		In a lead-acid battery used in an EV or backup system, water levels drop during repeated charging cycles. Why water required and what happens if it is not maintained?	*3*	*K3*	*CO2*
20.		In a fuel cell system, how is the ideal voltage generated from chemical reactions defined and applied to determine performance?	*3*	*K3*	*CO2*
21.		Classify the various modes of SRM to explain the different operating conditions.	*3*	*K4*	*CO3*
22.		Compare the hybrid electric drive trains integrate both the internal combustion engine and electric motor to improve vehicle performance and efficiency.	*3*	*K4*	*CO4*
23.		Identify the advantages of using a series hybrid electric drive train in vehicle applications. Mention any four merits.	*3*	*K3*	*CO4*
24.		Classify the various charging methods used for EVs and choose the charging methods for various applications.	*3*	*K4*	*CO5*

PART - B (Descriptive Answer Questions)
(5 × 12 = 60 Marks)
Answer ALL Questions

25.	a)	Utilize the concept of tractive effort in electric vehicles to determine the vehicle performance and its applications.	*12*	*K3*	*CO1*
		OR			
	b)	Develop the block diagram for the different power flow control modes of a typical parallel hybrid system and explain.	*12*	*K3*	*CO1*
26.	a)	Apply the working principle of a fuel cell and explain the operation in practical energy conversion systems.	*12*	*K3*	*CO2*
		OR			
	b)	Make use of the energy storage concept to differentiate the supercapacitor and a battery as energy storage devices in electric vehicles (EVs).	*12*	*K3*	*CO2*
27.	a)	Construct the block diagram to describe the closed-loop operation of a switched reluctance motor (SRM).	*12*	*K3*	*CO3*
		OR			
	b)	Develop the structure of the power controller used in a Permanent Magnet Brushless DC (PMBLDC) motor drive.	*12*	*K3*	*CO3*
28.	a)	Analyze the architecture and power flow control of a series Hybrid Electric Vehicle (HEV) and explain.	*12*	*K4*	*CO4*
		OR			
	b)	Examine the control strategy of a parallel hybrid electric drive train with a flow chart and explain it.	*12*	*K4*	*CO4*
29.	a)	Inspect the commonly used termination methods in battery charging and explain how they ensure safe and efficient operation.	*12*	*K4*	*CO5*
		OR			
	b)	Analyze the operation of an isolated bidirectional DC-DC converter used in EV charging systems and explain it.	*12*	*K4*	*CO5*