Reg. No.															

Question Paper Code	13866

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

Seventh Semester

Electrical and Electronics Engineering

20EEPC702 - ELECTRIC VEHICLES

Regulations - 2020

Duration: 3 Hours | Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	The performance of an EV mainly depends on (a) Engine size (b) Battery capacity and motor power (c) Gearbox ratio (d) Fuel injection timing	1	K1	CO1
2.	The main drawback of a parallel hybrid system is (a) Complex mechanical coupling (b) High energy loss (c) Poor regenerative braking (d) High fuel consumption	1	K1	CO1
3.	The key performance criteria for energy storage systems are (a) Energy density, Power density, and Efficiency (b) Speed, Torque, and Current (c) Weight, Color, and Size (d) Frequency, Capacitance, and Resistance	1	K1	CO2
4.	The energy storage mechanism of a supercapacitor is based on (a) Faradaic reaction (b) Double-layer capacitance (c) Ion exchange only (d) Combustion process	1	K1	CO2
5.	Field weakening in a DC motor is used to (a) Increase torque (b) Decrease speed (c) Increase speed above base speed (d) Reduce armature current	1	K1	CO3
6.	The controller in an EV drive regulates (a) Battery voltage only (b) Motor current and torque (c) Motor speed only (d) Inverter losses	1	K1	CO3
7.	In parallel hybrid drive, the design of engine power capacity is based on (a) Peak motor power (b) Average vehicle load and cruising speed (c) Battery charging rate (d) Regenerative braking efficiency	1	K1	CO4
8.	In terms of component sizing, the series hybrid requires (a) Smaller traction motor than parallel hybrid (b) Larger traction motor than parallel hybrid (c) Smaller engine than parallel hybrid (d) No generator	1	K1	CO4
9.	Fast charging of batteries may reduce battery life due to (a) Increased electrolyte density (b) Excessive heat and overvoltage (c) High internal resistance (d) Constant voltage	1	K1	CO5
10.	Transformer-less chargers are mainly used for (a) Reducing cost, size, and weight (b) Providing galvanic isolation (c) High-frequency isolation (d) Maximum current operation	1	K1	CO5

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

11.	List the main components of a battery electric vehicle.	2	K1	CO1
12.	Write the energy consumption for an EV travelling for a given distance.	2	K2	CO1
13.	Illustrate the factors influencing energy consumption of EVs.	2	K2	CO1
14.	State two advantages of super capacitors over batteries.	2	K1	CO2
15.	Describe the equivalent circuit model of a battery.	2	K2	CO2

16.	Draw the equivalent circuit model to calculate the terminal voltage of a battery.		*2*	*K2*	*CO2*
17.	Examine how regenerative braking influences energy efficiency.		*2*	*K2*	*CO3*
18.	Draw the torque–speed characteristics of PMBLDC used in EVs.		*2*	*K2*	*CO3*
19.	Define control strategy in hybrid electric vehicles.		*2*	*K1*	*CO4*
20.	Compare the power rating requirements of traction motors in Series and Parallel Hybrid configurations.		*2*	*K2*	*CO4*
21.	Describe the constant current and constant voltage charging methods.		*2*	*K2*	*CO5*
22.	Explain the purpose of using a high-frequency transformer in isolated charger topology.		*2*	*K2*	*CO5*

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

23.	a)	(i)	Apply the concept of tractive effort to determine the performance of an electric vehicle under normal driving conditions.	*6*	*K2*	*CO1*
		(ii)	Demonstrate how traction motor characteristics affect the vehicle's acceleration and gradeability.	*5*	*K2*	*CO1*
			OR			
	b)		Illustrate the architecture of a Hybrid Electric Drive Train and explain the function of its major components.	*11*	*K2*	*CO1*
24.	a)		Illustrate the operation of any one type of battery with merits and demerits.	*11*	*K2*	*CO2*
			OR			
	b)		Compare the dynamic response of a battery and PEMFC in an electric power train system.	*11*	*K2*	*CO2*
25.	a)		Apply the speed control principles of DC motor drives for EV propulsion and explain with relevant diagrams.	*11*	*K2*	*CO3*
			OR			
	b)		Explain the torque–speed characteristics of an SRM drive and explain its closed loop control strategy for EV propulsion.	*11*	*K2*	*CO3*
26.	a)		Explain the modes of operation for Max-SOC PPS method in a Parallel Hybrid Electric Vehicle.	*11*	*K2*	*CO4*
			OR			
	b)		Illustrate the operation of Series Hybrid Electric Drive Train with extended block diagram.	*11*	*K2*	*CO4*
27.	a)		Explain the function of bidirectional power flow in DC–DC converters used for EV battery charging and discharging.	*11*	*K2*	*CO5*
			OR			
	b)		Illustrate how the Z-converter topology enhances voltage gain and efficiency in charging circuits.	*11*	*K2*	*CO5*
28.	a)	(i)	Apply the concept of energy management to show how the control strategy optimizes fuel efficiency in Series Hybrid Electric Vehicles.	*6*	*K3*	*CO4*
		(ii)	Illustrate the working principle of a transformer-less charger topology and explain its application for onboard EV chargers.	*5*	*K2*	*CO5*
			OR			
	b)	(i)	Illustrate the component interaction and power flow in Parallel Hybrid Drive Trains with a neat block diagram.	*6*	*K3*	*CO4*
		(ii)	Apply the constant current and constant voltage charging methods to explain the charging process of a Li-ion battery.	*5*	*K2*	*CO5*