Reg. No.																

Question Paper Code	13946

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

Seventh Semester

Mechanical Engineering

20MEEL705 - HYBRID VEHICLES

Regulations - 2020

Duration: 3 Hours | Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	What is a key component in the configuration of electric vehicles? (a) Carburetor (b) Battery (c) Fuel tank (d) Radiator	1	K1	CO1
2.	When did the first hybrid vehicles appear in history? (a) 19th century (b) 20th century (c) 21st century (d) 18th century	1	K1	CO1
3.	Which component in a manual transmission system engages and disengages the engine from the transmission? (a) Gear stick (b) Clutch (c) Differential (d) Torque converter	1	K1	CO2
4.	Which type of electric drive-train topology combines features of both series and parallel configurations? (a) Pure electric (b) Parallel (c) Series-parallel (d) Hydraulic	1	K1	CO2
5.	Which of the following is a primary advantage of EVs? (a) Higher fuel consumption (b) Zero tailpipe emissions (c) Complex design (d) Increased noise	1	K1	CO3
6.	In a DC motor, which component is responsible for converting electrical energy into mechanical energy? (a) Rotor (b) Stator (c) Commutator (d) Armature	1	K1	CO3
7.	Supercapacitors store energy primarily in which form? (a) Chemical energy (b) Kinetic energy (c) Electrostatic energy (d) Thermal energy	1	K1	CO4
8.	How does a flywheel store energy? (a) By compressing air (b) By rotating mass (c) By storing fuel (d) By generating heat	1	K1	CO4
9.	One key challenge related to the electrification of heavy-duty vehicles is: (a) Battery technology limitations for long-range applications (b) Increased battery production capacity (c) Use of renewable energy for charging (d) High availability of charging stations	1	K1	CO5
10.	In a parallel hybrid electric vehicle (HEV), power is delivered to the wheels by: (a) Only the electric motor (b) Only the internal combustion engine (c) Either the electric motor, the internal combustion engine, or both (d) The battery alone	1	K1	CO6

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

		Marks	K – Level	CO
11.	What are the primary components of an electric vehicle?	2	K1	CO1
12.	Name two factors that influence the performance of electric vehicles.	2	K1	CO1
13.	What is continuously variable transmission (CVT) system?	2	K1	CO2
14.	How would you describe the series hybrid drive-train topology?	2	K2	CO2
15.	Summarize the primary function of a commutator in a DC motor.	2	K2	CO3
16.	State one key difference between a DC motor and an induction motor.	2	K2	CO3

17.	Define battery cycle life in the context of electric vehicles.		2	K1	CO4
18.	Explain how supercapacitors differ from batteries in terms of energy storage.		2	K2	CO4
19.	Outline the main challenges faced in the electrification of vehicles.		2	K2	CO5
20.	Explain why the development of charging infrastructure important for the Indian e-mobility roadmap.		2	K2	CO5
21.	Explain how a series electric vehicle configuration works.		2	K2	CO6
22.	Why is battery management important in different electric vehicle configurations?		2	K2	CO6

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

23.	a)	Explain the importance of traction motor characteristics in electric vehicle design.	11	K2	CO1
		OR			
	b)	Summarize history of hybrid and electric vehicles, highlighting key developments.	11	K2	CO1
24.	a)	Explain the basic structure and components of at least two electric drive-train topologies.	11	K2	CO2
		OR			
	b)	Compare the basic concepts of electric and hybrid drive-trains.	11	K2	CO2
25.	a)	Explain how environmental benefits of adopting Electric Vehicles (EVs) compared to traditional internal combustion engine vehicles.	11	K2	CO3
		OR			
	b)	Describe how armature voltage control and field flux control methods regulate the speed of a DC motor.	11	K2	CO3
26.	a)	Describe the main components of a lithium-ion battery used in electric vehicles.	11	K2	CO4
		OR			
	b)	Explain the working principle of a hydrogen fuel cell in energy storage for electric vehicles.	11	K2	CO4
27.	a)	Explain the key components of the e-mobility business model and how they contribute to the overall ecosystem of electric mobility.	11	K2	CO5
		OR			
	b)	Describe how e-mobility businesses can adapt to and overcome electrification challenges such as infrastructure development, battery technology, and cost-efficiency.	11	K2	CO5
28.	a)	Explain the working principle of a series electric vehicle configuration and discuss how it impacts vehicle performance in terms of efficiency and power delivery.	11	K2	CO6
		OR			
	b)	Discuss the working principle of an all-electric vehicle (EV) configuration and explain how battery technology influences its overall performance.	11	K2	CO6