Reg. No.															

Question Paper Code	14341

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

Seventh Semester

Mechanical Engineering

20MEEL705 - HYBRID VEHICLES

Regulations - 2020

Duration: 3 Hours | Max. Marks: 100

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

Answer ALL Questions

		Marks	K – Level	CO
1.	How do modern drive-trains impact energy supply? a) They increase reliance on fossil fuels b) They reduce dependence on non-renewable energy sources c) They have no impact on energy supply d) They increase emissions	1	K1	CO1
2.	What is a hydraulic hybrid vehicle? a) A vehicle that uses water as fuel b) A vehicle that combines a hydraulic system with a traditional engine c) A vehicle that runs only on electricity d) A vehicle that uses compressed air for propulsion	1	K1	CO1
3.	What is the main challenge in developing hydraulic hybrid vehicles? a)Finding appropriate electrical components b) Managing the high pressure of hydraulic fluids c) Increasing fuel tank size d) Enhancing the sound system	1	K1	CO1
4.	Which type of transmission system uses a clutch and gear stick? a) Automatic transmission b) Manual transmission c) Continuously variable transmission (CVT) d) Dual-clutch transmission (DCT)	1	K1	CO2
5.	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
6.	What is the role of power flow control in electric drive-train topologies? a) To manage the fuel injection b) To optimize energy usage and distribution c) To control the vehicle's speed d) To regulate tire pressure	1	K1	CO2
7.	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
8.	In a DC motor, which component is responsible for converting electrical energy into mechanical energy? a) Rotor b) Stator c) Commutator d) Armature	1	K2	CO3
9.	Permanent Magnet Synchronous Motors (PMSM) are widely used in: a) Electric vehicles b) Power plants c) HVAC systems d) Household fans	1	K1	CO3
10.	Show the parameter is the most critical when analyzing the performance of a battery for electric vehicles? a) Voltage output b) Battery capacity c) Number of wheels in the vehicle d) Paint type on the vehicle	1	K2	CO4

11.	Relate the factor is crucial in determining the capacity of energy storage systems in electric vehicles? a) Vehicle color b) Energy density c) Weight of passengers d) Road conditions	*1*	*K2*	*CO4*
12.	What by product is produced when hydrogen fuel cells generate electricity? a) Carbon dioxide b) Water c) Methane d) Nitrogen	*1*	*K1*	*CO4*
13.	Which aspect is essential for the success of the e-mobility business? a) Fossil fuel subsidies b) Development of EV charging networks c) Reducing renewable energy adoption d) Increasing CO2 emissions	*1*	*K1*	*CO5*
14.	The social dimension of e-mobility focuses on: a) Reducing public transport options b) Increasing vehicle emissions c) Improving air quality, reducing noise pollution, and enhancing public health d) Reducing access to electric vehicles	*1*	*K2*	*CO5*
15.	In hybrid electric vehicles, the term "blended mode" refers to: a) The use of gasoline only b) The simultaneous use of the electric motor and the internal combustion engine to drive the vehicle c) The vehicle running on battery power alone d) A mode in which regenerative braking is disabled	*1*	*K2*	*CO6*
16.	In electric vehicles, torque delivery is: a) Delayed until the vehicle reaches a high speed b) Available almost instantly, providing rapid acceleration c) Controlled by the internal combustion engine d) Only generated during braking	*1*	*K2*	*CO6*

PART – A (ii) (Short Answer Questions)
(6 × 3 = 18 Marks)
Answer ALL Questions

17.	Choose any two parameters used to evaluate vehicle performance.	*3*	*K3*	*CO1*
18.	Utilize the purpose of the clutch in a manual transmission system.	*3*	*K3*	*CO2*
19.	Identify any two methods used to control the speed of a DC motor.	*3*	*K3*	*CO3*
20.	Relate the importance of hybridization in electric vehicle energy storage systems.	*3*	*K2*	*CO4*
21.	Explain how connected mobility supports e-mobility solutions.	*3*	*K2*	*CO5*
22.	How does the combination of an electric motor and internal combustion engine improve performance in hybrid configurations?	*3*	*K2*	*CO6*

PART - B (Descriptive Answer Questions)
(6 × 11 = 66 Marks)
Answer ALL Questions

23.	a)	Build and provide a detailed history of hybrid and electric vehicles, highlighting key developments.	*11*	*K3*	*CO1*
		OR			
	b)	Construct and discuss the advantages and disadvantages of electric vehicles compared to conventional vehicles	*11*	*K3*	*CO1*
24.	a)	Utilize the potential for integrating renewable energy sources with electric and hybrid drive-trains.	*11*	*K3*	*CO2*
		OR			
	b)	Construct and explain the basic structure and components of at least two electric drive-train topologies.	*11*	*K3*	*CO2*

25.	a)	Describe how electromagnetic induction enables torque generation in an induction motor.	*11*	*K3*	*CO3*
		OR			
	b)	Construct and brief about the environmental benefits of adopting Electric Vehicles (EVs) compared to traditional internal combustion engine vehicles.	*11*	*K3*	*CO3*
26.	a)	Choose the major advantages of using fuel cells over traditional batteries in electric vehicles.	*11*	*K3*	*CO4*
		OR			
	b)	Construct and brief about the working principle of a hydrogen fuel cell in energy storage for electric vehicles.	*11*	*K3*	*CO4*
27.	a)	Build a case study on the E-mobility Indian Roadmap and explain its implications for the development of connected and autonomous mobility in India.	*11*	*K3*	*CO5*
		OR			
	b)	Develop the key components of the e-mobility business model and how they contribute to the overall ecosystem of electric mobility.	*11*	*K3*	*CO5*
28.	a)	Select the working principle of plug-in hybrid electric vehicles (PHEVs) and analyze how their dual power sources affect performance in various driving conditions.	*11*	*K3*	*CO6*
		OR			
	b)	Choose the parallel electric vehicle configuration and explain how it differs from the series configuration in terms of energy flow and performance.	*11*	*K3*	*CO6*