O.P.Code:23ME0343 | R23 | H.T.No.

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR
(AUTONOMOUS)
B.Tech. III Year II Semester Regular Examinations April-2026
INTRODUCTION TO HYBRID AND ELECTRIC VEHICLES
(Mechanical Engineering)

Time: 3 Hours **Max. Marks: 70**

PART-A
(Answer all the Questions **10 x 2 = 20** Marks)

1	a	Define tractive power and explain how it is calculated in an electric vehicle.	CO1	L2	2M
	b	Compare Nickel-Metal Hydride (NiMH) batteries with Lithium-Ion (Li-Ion) batteries in terms of their application in electric vehicles.	CO1	L2	2M
	c	What is the role of electric vehicle power plants?	CO2	L2	2M
	d	What are the two main types of induction motors?	CO2	L2	2M
	e	Define "energy efficiency" in the context of hybrid and electric drive systems.	CO3	L2	2M
	f	Name one key factor that affects the efficiency of DC motor drives in hybrid vehicles.	CO3	L2	2M
	g	In the charge-sustaining mode of a hybrid vehicle, how is the battery charged?	CO4	L2	2M
	h	What is meant by a charge-depleting mode in a hybrid vehicle?	CO4	L2	2M
	i	What is the main benefit of combining an electric motor with an IC engine in a hybrid vehicle?	CO5	L2	2M
	j	State one criterion used for selecting an energy storage system for hybrid vehicles.	CO5	L2	2M

PART-B
(Answer all Five Units **5 x 10 = 50** Marks)

UNIT-I

2	a	Compare an electric vehicle (EV) with that of an internal combustion engine (ICE) vehicle	CO1	L3	5M
	b	Explain the force-velocity characteristics of an electric vehicle's propulsion system.	CO1	L2	5M
		OR			
3	a	What is State of Charge (SOC) and explain its importance in battery management systems.	CO1	L2	5M
	b	Describe the process of battery cell balancing and its role in maintaining battery health and efficiency.	CO1	L4	5M

UNIT-II

4	a	Explain the basic structure of an electric vehicle power plant.	CO2	L3	5M
	b	Compare induction motors and permanent magnet motors for EV use.	CO2	L4	5M
		OR			
5	a	Explain the principle of Pulse Width Modulation (PWM) and its role in AC drive systems.	CO2	L3	5M
	b	What is the importance of current control in AC drive systems?	CO2	L2	5M

UNIT-III

6	a	Compare hybrid traction and electric traction with respect to power sources and energy usage.	CO3	L4	5M
	b	Describe series, parallel, and series-parallel hybrid drive train topologies with neat explanations.	CO3	L5	5M
		OR			
7		Compare the efficiency characteristics of DC motors, induction motors, and permanent magnet motors used in EV drive trains.	CO3	L4	10M

UNIT-IV

8	a	Compare the Toyota Prius and Honda Insight in terms of their hybrid systems.	CO4	L4	6M
	b	Describe the drivetrain configuration of the Mitsubishi MiEV.	CO4	L4	4M
		OR			
9	a	Discuss the key features of the Nissan Leaf as a fully electric vehicle.	CO4	L3	5M
	b	Distinguish between plug-in hybrid vehicles (PHEVs) and full hybrid vehicles (HEVs).	CO4	L4	5M

UNIT-V

10	a	Explain the importance of hybrid vehicle design in reducing fuel consumption.	CO5	L3	5M
	b	Model the matching process of an electric motor and IC engine in a hybrid vehicle.	CO5	L5	5M
		OR			
11		Compare the mild hybrids and full hybrids.	CO5	L5	10M

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