Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–VII (NEW) EXAMINATION – WINTER 2024

Subject Code:3170923 Date:19-11-2024

Subject Name: Electrical and Hybrid Vehicle

Time:10:30 AM TO 01:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			Marks
Q.1	**(a)**	What is the need and importance of electric and hybrid electric vehicles?	**03**
	(b)	With the help of a neat block diagram explain different subsystems of electric drive train.	**04**
	(c)	Derive equations & explain different types of forces acting on vehicle going uphill with neat diagram.	**07**
Q.2	**(a)**	Compare hybrid electric vehicles with conventional vehicles.	**03**
	(b)	Write two merits and two demerits of electric vehicles.	**04**
	(c)	Draw and explain architecture and power flow control of parallel hybrid electric drive train.	**07**
		OR	
	(c)	(i)Compute aerodynamic drag, rolling resistance & gradient force for the following vehicle assuming ρ=1.2 kg/m^3 & θ = 8º. Gross vehicle weight = 1500 kg, C_D=0.3, Area = 2.5 m^2, μ=0.015, v = 80 kmph, Tyre radius = 0.3 m. (ii) Also compute total traction force assuming pick-up from 0 to 50 kmph in 20 sec, with linear acceleration & zero slope.	**07**
Q.3	**(a)**	What is plug-in HEV? Explain with figure.	**03**
	(b)	What is meant by (i) Series hybrid electric vehicle. (ii) Parallel hybrid electric vehicle.	**04**
	(c)	Define the terms charge capacity, specific energy, energy density, specific power, charge efficiency, energy efficiency, Life cycle of battery.	**07**
		OR	
Q.3	**(a)**	Give comparisons of Hybrid Electric Vehicles and Conventional Vehicles	**03**
	(b)	List the various components of HEV drive train. Mention the advantages of hybrid vehicles.	**04**
	(c)	With neat diagram explain the construction and working of lead-acid battery.	**07**
Q.4	**(a)**	Classify the electric motors drives for EV and HEV application.	**03**
	(b)	List the optimization based strategies in Hybrid Electrical Vehicles?	**04**
	(c)	Explain the basic principle of Super Capacitors based Energy Storage System in Hybrid Electric Vehicles?	**07**
		OR	
Q.4	**(a)**	What is the advantage of AC motor over DC motors for EV applications?	**03**
	(b)	Give a classification of different energy management strategies.	**04**
	(c)	Explain the fuel cell and flywheel as energy source elements in electric and Hybrid electric vehicles.	**07**

Q.5	**(a)**	List the various components of HEV drive train.	**03**
	(b)	Briefly explain construction and working of Switched Reluctance Motor.	**04**
	(c)	Discuss various electric drive train topologies.	**07**

OR

Q.5	**(a)**	Which types of qualities are required in electric motors for EV application?	**03**
	(b)	Draw only torque-speed characteristics of following motors. (1) DC Shunt Motor (2) Permanent Magnet Synchronous Motor (PMSM) (3) Switched Reluctance Motor (SRM) (4) Permanent Magnet Brushless DC Motor (PMBLDC).	**04**
	(c)	Explain the two-quadrant operation of chopper DC motor drive with suitable waveforms for electric vehicle.	**07**

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