Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (NEW) EXAMINATION – WINTER 2021

Subject Code:3170923 Date:17/12/2021

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)**	Give Comparisons of Hybrid Electric Vehicles and Conventional Vehicles?	**03**
	(b)	Explain different types of forces acting on vehicle going uphill.	**04**
	(c)	Explain historical development of automobile and development of interest and activity in the EV from 1890 to present day.	**07**
Q.2	**(a)**	What is need of transformation from Rotating Axes (α β, ,0) to Stationary Axes (d ,q, 0).	**03**
	(b)	Draw and illustrate Equivalent 2 phase induction machine in α β, axis and d, q axis.	**04**
	(c)	Compare series hybrid and parallel hybrid system with their merits and demerits.	**07**
		OR	
	(c)	Explain energy saving potential of hybrid drive trains.	**07**
Q.3	**(a)**	List economic and environmental impact of electric hybrid vehicle.	**03**
	(b)	Explain the steady state modelling of permanent magnet machines?	**04**
	(c)	Explain closed loop induction motor drive with constant volts/Hz control strategy.	**07**
		OR	
Q.3	**(a)**	What type of operation is known as flux weakening in permanent magnet machines?	**03**
	(b)	List major advantages of permanent magnet machines in Electrical Vehicles.	**04**
	(c)	Draw and Explain typical CAN network for HEVs?	**07**
Q.4	**(a)**	Define the term hybridness?	**03**
	(b)	Explain the difference between ultracapacitor and battery as an energy storage device for EV.	**04**
	(c)	Explain the need of drive cycle for EVs and HEVs and hence explain different drive cycles?	**07**
		OR	
Q.4	**(a)**	What are the main issues with fuel cells?	**03**
	(b)	Explain the steps to find battery capacity for Electrical or Hybrid Electrical Vehicle.	**04**
	(c)	Define the terms charge capacity, specific energy, energy density, specific power, charge efficiency, energy efficiency, C rate for batteries.	**07**
Q.5	**(a)**	List the optimization based strategies in Hybrid Electrical Vehicles?	**03**
	(b)	Explain about Lithium Based Batteries in Energy Storage System?	**04**
	(c)	Explain the Basic Principle of Super Capacitors based Energy Storage System in Hybrid Electric Vehicles?	**07**

OR

Q.5	**(a)**	Explain the need of Antilock brake system (ABS)	**03**
	(b)	Explain about Fly Wheel Technologies in Hybrid Electric Vehicles?	**04**
	(c)	Explain Electronically controlled regenerative braking system functioning as an ABS.	**07**

****

Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (NEW) EXAMINATION – SUMMER 2022

Subject Code:3170923 Date:14/06/2022

Subject Name:Electrical and Hybrid Vehicle

Time:02:30 PM TO 05:00 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)**	Give a detailed classification of Electrified Vehicles.	**03**
	(b)	Is Electric Vehicle (EV) a future of transportation? Justify your answer.	**04**
	(c)	Prepare a block diagram of Battery Electric Vehicle (BEV) with all necessary components and explain it in brief.	**07**
Q.2	**(a)**	Explain following terms (1) Vehicle to Grid (V to G) (2) Vehicle to Load (V to L) (3) Vehicle to Vehicle (V to V)	**03**
	(b)	Derive the vehicle dynamic equation and explain all acting forces on vehicle with appropriate figure.	**04**
	(c)	Draw and explain Hybrid Electric Vehicle (HEV) with appropriate block diagram. (Note: BEV + IC vehicle)	**07**
		OR	
	(c)	Draw and explain Hybrid Electric Vehicle (HEV) with appropriate block diagram. (Note: BEV + Fuel Cell vehicle)	**07**
Q.3	**(a)**	How many batteries (12 V, 20 Ah) are required to fulfill the requirements of 108V, 60 Ah for EV. Provide connection diagram	**03**
	(b)	What is a plug-in HEV? Explain with figure.	**04**
	(c)	Draw and explain a series-parallel HEV with appropriate diagram.	**07**
		OR	
Q.3	**(a)**	How fuel cell works?	**03**
	(b)	Compare BEV, FCEV with IC engine vehicle for efficiency and performance.	**04**
	(c)	What is a difference between series HEV and Parallel HEV? Compare with figure.	**07**
Q.4	**(a)**	How electric traction (locomotive) works? Explain with figure.	**03**

	(b)	Prepare and explain a complete driving control method for Induction Motor in electrical vehicle application.	**04**
	(c)	Define following terms (1) Specific energy (2) Specific power (3) Energy density (4) Ambient temperature (5) Life cycle of battery (6) Energy stored (7) Charge capacity	**07**
		OR	
Q.4	**(a)**	Which types of qualities are required in electric motors for EV application?	**03**
	(b)	Draw torque-speed characteristics of following motors and suggest best for EV with reason. (1) Induction Motor (IM) (2) Permanent Magnet Synchronous Motor (PMSM) (3) Switched Reluctance Motor (SRM) (4) Permanent Magnet Brushless DC Motor (PMBLDC)	**04**
	(c)	Compare Lead-acid battery, nickel-cadmium battery and lithium-iron batteries for following terms (put specific values only) (1) Nominal voltage level (2) Specific energy (3) Energy density (4) Number of life cycle (5) Material of Anode, cathode and electrolyte (6) Recharge time	**07**
Q.5	**(a)**	How flywheel works as an energy storage device?	**03**
	(b)	Give a classification of different energy management strategies.	**04**
	(c)	What is a driving cycle? Draw and explain different driving cycles. How it helps in modelling of EV?	**07**
		OR	
Q.5	**(a)**	What is a difference between batteries and super capacitor? (Explain with charging and discharging characteristic)	**03**
	(b)	Prepare schematic diagram of solar and grid connected charging station.	**04**
	(c)	Draw and explain driver circuit for 3 phase SRM.	**07**

****