

Time: 3 Hrs

Marks : 80

Note :

- **Question No.1 is compulsory.**
- Solve **ANY THREE** questions from the **remaining** five questions.
- Figure to the right indicates full marks.
- Assume suitable data wherever required, but justify the same.

		Marks
Q. 1	Attempt any four from the following. (Each 5 marks)	20
	a) Compare the characteristics and performance of different energy sources for EV application.	
	b) <i>What is the need and importance of electric vehicle?</i>	
	c) <i>Describe the concept of "Hybridness" and classify the HEV based on hybridness.</i>	
	d) State and explain the vehicle to grid and grid to vehicle operation in electric vehicle technology	
	e) Explain the performance parameter of the motors used in Electric vehicle	
Q2	a) Illustrate the historical background of EV / HEVs technology in brief. Also describe the current scenario of EV technology along with technology challenges associated it. (10)	(10)
	b) Describe the power flow scenario in a Parallel Hybrid and Series-Parallel Hybrid electric drive-train topologies. Also explain different modes of operation for both types of HEV (10)	(10)
Q.3	a) Draw and explain the ideal traction energy source (power plant) characteristic used in EV/HEVs. (6)	(6)
	State and define the key battery parameters (i) Battery capacity (ii) C rate (iii) SoC (iv) DoD (v) Specific Energy (vi) Energy Density. (6)	(6)
	b) What are the different battery charging modalities adopted for EV? (8)	(8)
	c) Explain each one in brief and also elaborate on standards adopted for the same worldwide. (8)	(8)
Q4.	Enlist the different architectures of hybrid electric drive train and explain the series hybrid electric drive train. (10)	(10)
	a) Describe in detail all modes of operation for series-parallel hybrid vehicle. (10)	(10)
	b) Describe the design parameters of the ICE and motors in series hybrid drive. (10)	(10)
Q5.	Compare and differentiate between the battery electric vehicle (BEV), hybrid electric vehicle (HEV), and plug in HEV (PHEV) technologies. (10)	(10)
Q6.	a) Explain the two quadrant operation of chopper dc motor drive with suitable waveforms for electric vehicle. (10)	(10)
	b) Explain fuel cell and flywheel as energy source element in electrical and hybrid electric vehicle. (10)	(10)
