Total No. of Questions: 6 *Total No. of Printed Pages:3*

Enrollment No.....

Faculty of Engineering
End Sem Examination Dec 2024
OE00093 Hybrid Electric Vehicles

Programme: B.Tech. Branch/Specialisation: All

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

			Marks	BL	PO	CO	PSO
Q.1	i.	Objective behind using a hybrid cars is- (a) Reduction in fuel consumption (b) Reduction in emission (c) Increased power and torque (d) All of these	**1**	01	01	01	
	ii.	Electric vehicle and hybrid vehicles have following components common except- (a) ICE (b) Battery (c) Generator (d) ECU	**1**	01	01	01	
	iii.	A plug-in hybrid is different from a conventional hybrid electric vehicle because it has- (a) Built in battery charger (b) Li-Ox battery (c) Bigger motor (d) None of these	**1**	01	01	02	
	iv.	Which of the following converts energy from the combustion of fuel directly to the electrical energy? (a) Ni-Cd cell (b) Dynamo (c) Fuel cell (d) Electrolytic cell	**1**	01	01	02	
	v.	Which of the following is a requirement for electric motors used in EVs/HEVs? (a) Low peak power (b) High efficiency at varying speeds (c) Low torque output (d) Very high torque output	**1**	01	01	03	

vi.	What is a primary advantage of Brushless DC Motors (BLDC) in EVs/HEVs? (a) Low maintenance requirements (b) High torque-to-weight ratio (c) Efficient at low speeds (d) All of these	**1**	01	01	03
vii.	In a buck-boost converter, what can be achieved? (a) Only step-up voltage (b) Only step-down voltage (c) Both step up and step-down voltage (d) Only convert AC to DC	**1**	01	01	04
viii.	What is the primary role of a DC-AC inverter in EV applications? (a) Charging the battery (b) Providing high voltage to the motor (c) Converting DC from the battery to AC for the motor (d) Step down the voltage	**1**	01	01	04
ix.	What is a primary advantage of battery-based energy storage in EVs/HEVs? (a) Low energy density (b) High efficiency and maturity of technology (c) Fast energy storage (d) Very long-life cycle	**1**	01	01	05
x.	Which of the following best describes a simplified model of a battery? (a) Resistor-capacitor (RC) circuit (b) Inductor-capacitor (LC) circuit (c) Purely resistive load (d) Constant voltage source	**1**	01	01	05

Q.2	i.	What is meant by state of charge of batteries?	**2**	01	01	01
	ii.	Discuss the electrical drive system or an electric vehicle with suitable block diagram.	**3**	01	03	01
	iii.	Describe the present technological trends of EVs/EHVs and the challenges associated with it.	**5**	01	02	02
OR	iv.	Describe the conceptual advantages of a hybrid electric vehicle over electric vehicles.	**5**	01	01	02

Q.3	i.	Explain the different configuration of electric vehicle.	**3**	01	01	02
	ii.	Explain the difference between HEVs and PHEVs with the help of block diagram.	**7**	01	02	03
OR	iii.	What is the operation pattern of series and parallel types of HEVs?	**7**	01	02	03
Q.4	i.	Discuss the different considerations in the design of power control strategies for HEVs.	**3**	01	03	03
	ii.	Justify the usage of PMSM in electric vehicle application.	**7**	01	03	03
OR	iii.	Compare the induction and BLDC motor with respect to electric vehicle application.	**7**	01	03	03
Q.5	i.	Discuss the mode of operations of boost and buck-boost converters with suitable block diagram.	**4**	01	03	04
	ii.	Explain the implementation of closed loop speed control of a two quadrant three phase converter-controlled DC motor drive system with suitable diagram.	**6**	01	03	04
OR	iii.	Discuss the implementation of pulse width modulation controller for dc motor chopper drive.	**6**	01	03	04
Q.6		Attempt any two:				
	i.	Explain the basic principle, advantages, and disadvantages of fuel cell.	**5**	01	07	05
	ii.	Explain the available options of the energy storage technologies for EVs.	**5**	01	01	05
	iii.	Discuss the approximate sizing of battery for a new design of electric vehicle.	**5**	01	03	05

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Marking Scheme
OE00093 (T) Hybrid Electric Vehicles (T)

			Marks
Q.1	i.	Objective behind using a hybrid cars is Answer: (d) All of these	**1**
	ii.	Electric vehicle and hybrid vehicles have following components common except Answer: (a) internal combustion engine	**1**
	iii.	A plug-in hybrid is different from a conventional hybrid electric vehicle because it has: Answer: (a) built in battery charger	**1**
	iv.	Which of the following converts energy from the combustion of fuel directly to the electrical energy? Answer: (c) Fuel cell	**1**
	v.	Which of the following is a requirement for electric motors used in EVs/HEVs? Answer: (b) High efficiency at varying speeds	**1**
	vi.	What is a primary advantage of Brushless DC Motors (BLDC) in EVs/HEVs? Answer: (b) High torque-to-weight ratio	**1**
	vii.	In a buck-boost converter, what can be achieved? Answer: (c) Both step up and step down voltage	**1**
	viii.	What is the primary role of a DC-AC inverter in EV applications? Answer: (c) Converting DC from the battery to AC for the motor	**1**
	ix.	What is a primary advantage of battery-based energy storage in EVs/HEVs? Answer: (b) High efficiency and maturity of technology	**1**
	x.	Which of the following best describes a simplified model of a battery? Answer: (a) Resistor-capacitor (RC) circuit	**1**
Q.2	i.	Explanation …….2 marks	**2**
	ii.	Diagram ……..1.5 marks Explanation …….1.5 marks	**3**
	iii.	Explanation …….3 marks Challenges …….2 marks	**5**
OR	iv.	Each advantage equal to 1 mark, ….5 advantages…equal to 5 marks	**5**
Q.3	i.	Each configuration equal to 1 mark….3 configurations…equal to 3 marks	**3**
	ii.	Diagram……..4 marks Each difference equal to 1 mark, …3 differences…….3 marks	**7**
OR	iii.	Each operation equal to 3.5 mark, …2 operations …….7 marks	**7**
Q.4	i.	Explanation ……..…….3 marks	**3**
	ii.	Explanation …….3 marks Applications …….4 marks	**7**
OR	iii.	Explanation …….3 marks Application …….4 marks	**7**
Q.5	i.	Diagram ……..2 marks Mode of operation ……..2 marks	**4**
	ii.	Diagram ……..…….2 marks Explanation ……..…….4 marks	**6**
OR	iii.	Statement ……..…….2 marks Explanation ……..…….4 marks	**6**
Q.6		Attempt any two:	
	i.	Basic principle equal to 2 marks Advantage and disadvantage equal to 3 marks	**5**
	ii.	Explanation ……..…….5 marks	**5**
	iii.	Sizing of battery……2 marks Explanation ……..…….3 marks	**5**

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