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

Enrollment No.....

Faculty of Engineering

End Sem Examination Dec-2023

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.

Q.1 i. Electric Vehicles Promotes- **1**

(a) Carbon reduction (b) reduces pollution

(c) Both (a) and (b) (d) None of these

ii. What is the major issue with the adoption of electric vehicle? **1**

(a) Charging infrastructure (b) Battery technology

(c) Drive train (d) None of these

iii. Which of the following vehicles produces zero emissions? **1**

(a) Battery electric vehicle (b) Hybrid vehicle

(c) IC engine vehicle (d) None of these

iv. From where tractive effort is generated in EV- **1**

(a) Battery (b) Converter

(c) Driving Shaft (d) Motor

v. Which of the following is not an advantage of BLDC motor over conventional DC motor? **1**

(a) Less maintenance

(b) Long life

(c) No risk of explosion or possibility of RF radiation

(d) Low cost

vi. Which motor is suitable for high starting torque? **1**

(a) Permanent Magnet Synchronous Motors

(b) Brushless DC motors

(c) Brushless AC motors

(d) Permanent Magnet induction Motors

P.T.O.

vii. Full form of VSI is _____. **1**
(a) Voltage source inverter (b) Volume source inverter
(c) Voltage severe inverter (d) Voltage source inserter

viii. What is the formula for output voltage for Buck converter? **1**
(a) 8D×Vin (b) 5D×Vin (c) 2D×Vin (d) D×Vin

ix. In a hybrid electric vehicle one energy source is _____ & the other is a conversion of a_____. **1**
(a) Combustion, energy to fuel
(b) Storage, energy to fuel
(c) Storage, energy to energy
(d) Storage, Fuel to energy

x. Fuel Cell use combination of- **1**
(a) Zinc & Sulphur (b) Sulphur & oxygen
(c) Hydrogen & Oxygen (d) Sodium & Sulphur

Q.2 i. Mention the advantages and applications of Electric and Hybrid Electric Vehicles. **4**

ii. Draw and explain the configurational block diagram of EV. **6**

OR iii. Explain historical background of hybrid electric vehicle. **6**

Q.3 i. Explain briefly Fuel Cell Electric Vehicles (FCEVs). **3**

ii. Draw and Explain the working principle of Plug-in hybrid Electric vehicles (PHEVs) in detail. **7**

OR iii. Draw and explain the architecture of Series and Series -Parallel hybrid electric drive train. **7**

Q.4 i. Draw and explain the torque Vs speed characteristics of motors used in electric vehicle. **4**

ii. Explain in detail BLDC motor and write its applications. **6**

OR iii. Compare various types of DC and AC machines used for EV applications. **6**

Q.5 i. Explain briefly PHEV battery chargers. **4**

ii. Draw and explain the block diagram of DC-AC Inverter. List the application of Inverter. **6**

OR iii. What is the working principle of buck-boost converters? Why is a buck boost converter used in an electric vehicle? **6**

Q.6 Attempt any two:

i. Explain super capacitor based energy storage. **5**

ii. Explain fuel cell and flywheel as energy source elements in electric and hybrid electric vehicles. **5**

iii. Explain in detail hybridization of various energy storage devices. **5**

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Scheme of Marking

Hybrid Electric Vehicles (T) - OE00093 (T)

Q.1	i)	Electric Vehicles Promotes- c) Both a & b	**1**
	ii)	What is the major issue with the adoption of electric vehicle? a) Charging infrastructure	**1**
	iii)	Which of the following vehicles produces zero emissions? a) Battery electric vehicle	**1**
	iv)	From where tractive effort is generated in EV d) Motor	**1**
	v)	Which of the following is not an advantage of BLDC motor over conventional DC motor. d) Low cost	**1**
	vi)	Which motor is suitable for high starting torque b) Brushless DC motors	**1**
	vii)	Full form of VSI is _____ a) Voltage source inverter	**1**
	viii)	What is the formula for output voltage for Buck converter? d) D×Vin	**1**
	ix)	In a hybrid electric vehicle one energy source is _____ & the other is a conversion of a_____ d) storage, Fuel to energy	**1**
	x)	Fuel Cell use combination of c) Hydrogen & Oxygen	**1**
Q.2	i.	Mention the advantages and applications of Electric and Hybrid Electric Vehicles? advantages -2 marks applications – 2 marks	**4**
	ii.	Draw and explain the configurational block diagram of EV. Diagram- 2 marks Explanation – 4 marks	**6**
OR	iii.	Explain historical background of hybrid electric vehicle. Explanation – 6 marks	**6**
Q.3	i.	Explain briefly Fuel Cell Electric Vehicles (FCEVs)? Explanation – 3 marks	**3**
	ii.	Draw and Explain the working principle of Plug-in hybrid Electric vehicles(PHEVs) in detail. Diagram- 3 marks Explanation – 4 marks	**7**
OR	iii.	Draw and explain the architecture of Series and Series -Parallel hybrid electric drive train. Diagram- 3 marks Explanation – 4 marks	**7**
Q.4	i.	Draw and explain the torque Vs speed characteristics of motors used in electric vehicle. Diagram- 2 marks Explanation – 2 marks	**4**
	ii.	Explain in detail BLDC motor and write its applications. Explanation – 4 marks Application – 2 marks	**6**
OR	iii.	Compare various types of DC and AC machines used for EV applications. At least 6 points- 1 mark each	**6**
Q.5	i.	Explain briefly PHEV battery chargers. Explanation- 4 marks	**4**
	ii.	Draw and explain the block diagram of DC-AC Inverter. List the application of Inverter. Diagram- 2 marks Explanation – 3 marks Applications – 1 mark	**6**

OR iii. What is the working principle of buck-boost converters? Why is a buck boost converter used in an electric vehicle? **6**
working principle – 4 marks
reason for buck boost converter used in an electric vehicle – 2 marks

Q.6 Attempt any two:

i. Explain super capacitor based energy storage **5**
Explanation – 5 points (1 marks each)

ii. Explain fuel cell and flywheel as energy source elements in electric and hybrid electric vehicles **5**
fuel cell energy source elements- 2.5 marks
flywheel as energy source elements – 2.5 marks

iii. Explain in detail hybridization of various energy storage devices **5**
various energy storage devices- at least 5 devices- 5 marks

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