2/12/2023

Paper / Subject Code: 48850 / Honours/Minor degree programs EV Drive and Energy Sources

TE Sem VI (R-2019 C scheme) "Mechanical" Dec 2023

(Time -3 hours) **Max. Marks: 80**

Note: 1. Question number **1 is compulsory**.
2. Solve **any three** out of remaining questions.
3. Figures to the right indicate full marks
4. Assume suitable data if necessary and justify

Q1. Solve any four. **5 marks each**

a) Draw the schematic of compete electrical circuit connecting energy source to electrical motor in an electric vehicle (EV).

b) What is Battery Management System (BMS) and its significance in safety of EVs?

c) Compare the Permanent Magnet Synchronous motor and Induction motor for 4 wheeler EV applications.

d) Illustrate the working of Wireless Power Transfer (WPT) technology used in EV charging.

e) List various EV charging connectors adopted worldwide with their specifications.

Q2 Solve the following questions **10 marks each**

A) Illustrate and compare the well to wheel efficiency scenario in Electric Vehicles with conventional charging station and renewable energy based charging stations.

B) Compare and justify the requirements for 4 wheeler EV, and 2 wheeler EV in the context of (i) electric motor, (ii) energy sources, (iii) safety and (iv) EV charging.

Q3 Solve the following questions **10 marks each**

A) Compare the performance of following electrical machines against their suitability for EV application (i) Induction Motor (ii) BLDC motor. For any one of them, explain a typical power converter topology and control strategy which can be adopted for EV application.

B) Illustrate the Space Vector modulation (SVM) techniques used for EV inverters. Compare SVM with other modulation techniques.

Q4 Solve the following questions **10 marks each**

A) Explain the typical power converter topology used in G2V and V2G technology in EVs with the help of suitable diagrams.

B) State and differentiate various charging methods adopted for the EVs. Also illustrate various standards/ protocols adopted in India for EV charging.

Q5 Solve the following questions **10 marks each**

A) State and describe the significance of the key battery parameters (i) Battery capacity (ii) C rate (iii) SoC (iv) DoD (v) Specific energy (vi) Energy Density in the context of EV.

B) Describe the concept of a drive cycle in electric vehicle. What parameters of the EV are tested and verified in driving cycle test? List various drive cycles typically adopted in EV testing.

Q6 Solve the following questions **10 marks each**

A) Compare various type of battery technologies used in EV applications. What are the other alternatives in energy sources commonly adopted in EVs? Compare their performance.

B) Explain Variable-Voltage Variable-Frequency Control method for an Induction motor

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