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

Sem VI (R-2019 C Scheme) "Mechanical" May 2023

TE

7/5/2023

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) Differentiate between onboard and off-board chargers.
b) Explain the concept of efficiency map of an electric machine.
c) What are the various types' losses occurring in power converters?
d) Explain the advantages and issues in V2G technology.
e) Differentiate between Induction motor and permanent magnet synchronous motor.

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

A) Explain the construction and working of switched reluctance motor and write its advantages and disadvantages.
B) Explain in detail the principle of operation of BLDC motor.

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

A) Explain how the sinusoidal pulse width modulation technique is used to control the operation of inverter with suitable diagram.
B) An electric vehicle having battery of nominal voltage 60V and nominal current of 48Ah, is running at a constant speed of 50km/hr. The battery is discharged at constant rate of 15A. Initial battery SoC is 100% and the vehicle is driven until battery SoC becomes 50%. Assume zero system losses, determine the following.
   i. Energy rating of battery.
   ii. Discharge time of battery.
   iii. Total distance travelled by vehicle.
   iv. Total distance travelled when battery SoC becomes 0%.

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

A) Explain Field-Oriented Control method for permanent magnet synchronous motor (PMSM).
B) What are the causes and effects of cell imbalance in a battery pack? What are cell the various cell balancing techniques?

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

A) Write the significance of hybridization of energy sources and explain its types.
B) What is battery energy efficiency? Determine the ampere-hour and watt-hour efficiencies of a battery, which is charged for 12 hours at 25A at an average voltage of 25V and is discharged in 10 hours at a load of 20A at an average voltage of 22.5V.

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

A) Draw and explain the renewable energy-based charging infrastructure.
B) What is the significance of drive cycle? Explain various drive cycles.

****