

December 2023

B.Tech (EL(Minor Degree(EVT)) V SEMESTER

Energy Storage Systems for Vehicles (MD-EV-502)

Time: 3 Hours

Max. Marks:75

- Instructions:**
1. It is compulsory to answer all the questions (1.5 marks each) of Part -A in short.
 2. Answer any four questions from Part -B in detail.
 3. Different sub-parts of a question are to be attempted adjacent to each other.

PART -A

- Q1 (a) Define battery capacity and energy density (1.5)
- (b) Explain the fundamental working principle of Ultra Capacitors. (1.5)
- (c) Explain the importance of battery models in predicting the behavior of (1.5)
batteries
- (d) What considerations should be taken into account when determining the (1.5)
optimal placement of a charging station for electric vehicles?
- (e) Define hybrid energy storage systems. (1.5)
- (f) What are the fundamental differences in operation between super capacitors (1.5)
and batteries?
- (g) What advantages do solid-state batteries offer compared to traditional (1.5)
batteries ?
- (h) What factors influence the sizing of the boost inductor in a Boost PFC circuit? (1.5)
- (i) Define State of Charge (SOC) and State of Health (SOH) (1.5)
- (j) Write down the two limitations of fuel cells . (1.5)

PART -B

- Q2 (a) Design a comparative study between different types of batteries use of Electric (10)
vehicles
- (b) Describe the discharge curve of a battery pack. How does the discharge curve (5)
change over the lifespan of a battery, and what role does aging play in this
process?
- Q3 (a) Explain the challenges and strategies associated with recycling batteries used (5)
in EVs?.
- (b) Explain the key components of a typical electric vehicle charging station and (10)
their functions..
- Q4 (a) Explain the key components and purpose of the Boost PFC power stage in a (8)
power supply system.
- (b) Describe the typical structure of Battery Management Systems. (7)

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- Q5 (a) Explain the significance of using Graphene in ultra-capacitors (8)
- (b) How does the choice of hydrogen generation method impact the overall efficiency of fuel cell systems? (7)
- Q6 (a) Explain different types of Charger architectures. (8)
- (b) Explain the advantages and limitations of flywheel energy storage systems in comparison to other energy storage technologies. (7)
- Q7 (a) Explain the basic working principle of an electrochemical Super capacitor, focusing on the role of electrodes and electrolyte in energy storage. (8)
- (b) Explain Energy Management strategies. (7)
