

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)**

**CLASS: M.Tech
BRANCH: EEE/EVT**

**SEMESTER : II
SESSION : SP/2024**

SUBJECT: EE547 BATTERY MANAGEMENT SYSTEM

TIME: 3 Hours

FULL MARKS: 50

INSTRUCTIONS:

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
 2. Attempt all questions.
 3. The missing data, if any, may be assumed suitably.
 4. Before attempting the question paper, be sure that you have got the correct question paper.
 5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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			CO	BL
Q.1(a)	Analyze the charging phenomena of battery using CC/CV and CP/CV mode to identify the voltage, current, power and SoC characteristic.	[5]	CO1	4
Q.1(b)	A Battery is constructed from ten 3.5V, 50Ah Cells. Determine the (i) nominal voltage, (ii) nominal capacity, (iii) nominal energy capacity, when connected in (a) Series, (b) Parallel.	[5]	CO1	4
Q.2(a)	Develop the BMS protection logic for protection against over-voltage, temperature and over-current	[5]	CO2	6
Q.2(b)	A 12 V lead acid battery with capacity of 300 Ah having an identical resistance of 0.2 Ohms. The battery is theoretically discharged up-to it's cut-off voltage in 20 hrs. Analyze the C-rate and efficiency of the battery for optimum usage.	[5]	CO4	4
Q.3(a)	Examine using HPPC test the attained cell resistance at different SoC and temperature.	[5]	CO3	4
Q.3(b)	Implement the least square technique for SoH estimation. Analyze the significance of SoH estimation.	[5]	CO3	3&4
Q.4(a)	Evaluate the terminal cell/ pack voltage using the Thevenin's equivalent circuit models. Also estimate it's advantage over the R_{int} Model for identifying it's effectiveness in BMS.	[5]	CO4	5
Q.4(b)	Estimate the differences between electrochemical and Equivalent circuit model.	[5]	CO4	2
Q.5(a)	Judge the significance of active cell balancing with multiple switched capacitors over single switched capacitor for meeting the state-of-art technique of cell balancing in BMS.	[5]	CO3	5
Q.5(b)	Evaluate SoC using Kalman filtering technique required for adaptive SoC estimation. Identify the converter operation required for charge distribution from battery pack to load.	[5]	CO3 & CO5	5 & 2

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