



**MEDICAPS**  
UNIVERSITY

## Faculty of Engineering

### End Semester Examination May 2025

#### OE00094 Battery Management Systems & Charging Stations

<b>Programme</b>	: B.Tech.	<b>Branch/Specialisation</b>	: All
<b>Duration</b>	: 3 hours	<b>Maximum Marks</b>	: 60

**Note:** All questions are compulsory. Internal choices, if any, are indicated. Assume suitable data if necessary.

Notations and symbols have their usual meaning.

Section 1 (Answer all question(s))		Marks	CO	BL
<b>Q1.</b>	When cells are connected in series, which parameter increases? <input checked="" type="radio"/> Voltage <input type="radio"/> Capacity <input type="radio"/> Power <input type="radio"/> Resistance	1	1	1
<b>Q2.</b>	What does the 'C rate' in battery terminology refer to? <input type="radio"/> Capacity of the battery <input type="radio"/> Chemical composition <input checked="" type="radio"/> Charging and discharging rate <input type="radio"/> Cell voltage	1	1	1
<b>Q3.</b>	What is the main advantage of CC charging? <input checked="" type="radio"/> Faster charging <input type="radio"/> Prevents overcharging <input type="radio"/> Maintains constant voltage <input type="radio"/> Reduces battery lifespan	1	1	1
<b>Q4.</b>	Which balancing method redistributes charge between cells? <input type="radio"/> Passive balancing <input checked="" type="radio"/> Active balancing <input type="radio"/> Overcharge balancing <input type="radio"/> Timer-based balancing	1	1	1
<b>Q5.</b>	What is the typical charging time for a DC fast charging station? <input type="radio"/> 5 minutes <input checked="" type="radio"/> 30-60 minutes <input type="radio"/> 4-6 hours <input type="radio"/> 10-12 hours	1	1	1
<b>Q6.</b>	What is the typical power range of a Level 2 AC charging station? <input type="radio"/> 1-3 kW <input checked="" type="radio"/> 3.7-22 kW <input type="radio"/> 50-150 kW <input type="radio"/> 250-350 kW	1	1	1
<b>Q7.</b>	What is the primary function of a Battery Management System (BMS)? <input type="radio"/> Convert AC to DC power <input checked="" type="radio"/> Monitor & protect battery pack <input type="radio"/> Optimize fuel efficiency <input type="radio"/> Increase motor speed	1	1	1
<b>Q8.</b>	Which communication protocol is commonly used in BMS for data transfer? <input type="radio"/> USB <input checked="" type="radio"/> CAN bus <input type="radio"/> Bluetooth <input type="radio"/> Wi-Fi	1	1	1
<b>Q9.</b>	Which software is commonly used for simulating battery models? <input type="radio"/> Photoshop <input checked="" type="radio"/> MATLAB/Simulink <input type="radio"/> AutoCAD <input type="radio"/> MS Excel	1	1	1
<b>Q10.</b>	Which battery type is more prone to the memory effect? <input type="radio"/> Li-ion <input checked="" type="radio"/> NiCd <input type="radio"/> Lead Acid <input type="radio"/> Solid-State	1	1	1

#### Section 2 (Answer all question(s))

Marks CO BL

**Q11.** State the advantages of lithium-ion batteries in EV applications.

2 1 2

Rubric	Marks
0.5 mark for each advantage	2

**Q12.** Explain how a cell and a battery are different from each other.

3 1 2

Rubric	Marks
0.5 marks for each difference.	3

**Q13. (a)** Describe the working principle of a lead-acid battery. Identify the chemical reactions take place during charging and discharging.

5 2 2

Rubric	Marks
The working principle of a lead-acid battery	3
Identify the chemical reactions take place during charging and discharging	2

(OR)

**(b)** Describe the working principle of a Sodium-Sulphur (NaS) battery. How does it compare to lithium-ion batteries in terms of energy density and applications?

Rubric	Marks
Describe the working principle of a Sodium-Sulphur (NaS) battery	3
How does it compare to lithium-ion batteries in terms of energy density and applications	2

### Section 3 (Answer all question(s))

Marks CO BL

**Q14.** Differentiate between passive balancing and active balancing.

4 2 2

Rubric	Marks
One mark for each difference ( difference in detail is required)	4

**Q15. (a)** Explain the working principle of CC/CV charging. Describe the two stages (constant current and constant voltage) and their significance in battery charging.

6 2 2

Rubric	Marks
working principle of each CC/CV charging (1.5 marks for each method)	3
Describe the two stages	2
Significance in battery charging	1

(OR)

**(b)** Explain the concept of MSCC charging and its advantages over traditional CC charging.

Rubric	Marks
concept of MSCC charging	4
advantages over traditional CC charging	2

### Section 4 (Answer all question(s))

Marks CO BL

**Q16.** Illustrate the main challenges in developing a wide spread public EV charging infrastructure.

4 3 2

Rubric	Marks
One Mark for each Challenge	4

**Q17. (a)** Describe types of EV charging infrastructure & its advantages.

6 3 3

Rubric	Marks
Different types of EV charging infrastructure with explanation	4
Advantages different types of EV charging infrastructure	2

(OR)

**(b)** Explain normal, occasional and fast charging station.

Rubric	Marks
Explain normal charging station.	2
Explain occasional charging station.	2
Explain fast charging station.	2

### Section 5 (Answer all question(s))

Marks CO BL

**Q18.** How does temperature sensing help prevent battery damage?

4 4 3

Rubric	Marks
Explain the reason How does temperature sensing help prevent battery damage	4

**Q19. (a)** Describe the function of diagnostics in a BMS. How does it help in fault detection and maintenance of EV batteries?

6 4 3

Rubric	Marks
function of diagnostics in a BMS	3
How does it help in fault detection and maintenance of EV batteries	3

(OR)

**(b)** Describe the different methods used by a BMS for SOC (State of Charge) estimation. How does it impact battery performance?

Rubric	Marks
Describe the different methods used by a BMS for SOC	4
Its impact battery performance	2

### Section 6 (Answer any 2 question(s))

Marks CO BL

**Q20.** Describe the structure of a Li-ion battery simulation model.

5 5 3

Rubric	Marks
Description 03 marks	3
Simulation Model	2

Q21. Explain the different approaches to battery modelling.

553

Rubric	Marks
Explain Different Approaches 2.5 marks each	5

Q22. Explain the impact of temperature and aging on battery modeling. How can these factors be included in a simulation model?

553

Rubric	Marks
Explain the impact of temperature	3
How can these factors be included in a simulation model	2

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