

# 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))

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

#### 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.

**5 5 3**

<b>Rubric</b>	<b>Marks</b>
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? **5 5 3**

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

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