U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

July 2023 Semester End Main Examinations

Programme: B.E. **Semester: VIII**
Branch: Institutional Elective **Duration: 3 hrs.**
Course Code: 23CY8IEBMT **Max Marks: 100**
Course: Battery Materials and Technology **Date: 06.07.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		UNIT - I	CO	PO	Marks
1	a)	What are batteries? Explain the importance of secondary batteries.	CO 1	PO1	**4**
	b)	Differentiate between batteries and super capacitors. Give any two specific applications of batteries and super capacitors.	CO 1	PO1	**8**
	c)	Explain the following battery characteristics: (i) Voltage (ii) Shelf life (iii) Energy density	CO 1	PO1	**8**
		UNIT - II			
2	a)	Explain the desired characteristics of the following key components of a battery (i) Anodic active material (ii) Separator.	CO 1	PO1	**6**
	b)	Elucidate the role of binders and electrolytes in energy storage devices. Give two examples each for binders and electrolytes used in supercapacitors.	CO 2	PO2	**7**
	c)	Elaborate on the safety testing methods and safety standards for batteries.	CO 1	PO1	**7**
		UNIT - III			
3	a)	What are primary and secondary batteries? With a neat diagram explain the construction, working and applications of Nickel-Cadmium battery.	CO 1	PO1	**8**
	b)	Explain the construction and working of Zn-air battery with relevant reactions.	CO 2	PO2	**8**
	c)	Give reason: (i)The energy density of Zn-air battery is higher than Ni-Cd battery (ii) Air holes are provided at the cathode side of the Zn-air battery.	CO 2	PO2	**4**
		OR			

	4	a)	Write the key components and reactions of the Zn-MnO_2 battery.	*CO 2*	*PO2*	**6**
		b)	Elaborate on the construction and working of Ni-Metal hydride battery.	*CO 2*	*PO2*	**8**
		b)	Write a neat diagram of Lead-acid battery and explain the construction and reactions.	*CO 1*	*PO1*	**6**
			UNIT - IV			
	5	a)	Describe the construction of Li-ion batteries. Elucidate the mechanism of working of Li-ion batteries with relevant electrochemical reactions.	*CO 1*	*PO1*	**6**
		b)	Explain the working of Li-Sulfur battery. What are the advantages of Li-S battery over other batteries?	*CO 1*	*PO1*	**7**
		c)	What are the opportunities and challenges of Li and Na ion batteries?	*CO 2*	*PO2*	**7**
			UNIT - V			
	6	a)	Explain the hydrometallurgical process of extraction of metals from used batteries.	*CO 1*	*PO1*	**6**
		b)	What are the hazardous effects of E-waste of battery materials on environment and health?	*CO 2*	*PO2*	**7**
		c)	Illustrate the necessity of recycling Li-ion battery.	*CO 2*	*PO2*	**7**
			OR			
	7	a)	Explain the sustainable process for recycling of a battery with suitable examples.	*CO 1*	*PO1*	**6**
		b)	Describe the battery disassembling process.	*CO 2*	*PO2*	**7**
		c)	Illustrate pyrometallurgical process used in extraction of Li from a battery.	*CO 2*	*PO2*	**7**

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