U.S.N.										

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

Autonomous Institute Affiliated to VTU

January / February 2025 Semester End Main Examinations

Programme: B.E. **Semester: III**

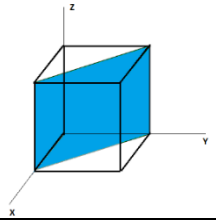
Branch: Chemical Engineering **Duration: 3 hrs.**

Course Code: 23CY3ESMCA / 22CY3ESMCA **Max Marks: 100**

Course: Material Chemistry and Applications

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)	Describe the band theory for conductors, semiconductors, and insulators.	1	1	**10**
	b)	Discuss the intermolecular forces present in (i) H_2 molecule (ii) H_2O (iii) Alcohol (iv) NaCl.	1	1	**10**
		OR			
2	a)	Derive Born-Lande equation for ionic crystals. Highlight its significance and limitations.	1	1	**10**
	b)	Based on molecular orbital theory explain the formation of HF and O_2 molecules. Calculate their bond order.	1	1	**10**
		UNIT - II			
3	a)	A plane in a unit cell of rock salt has intercepts as shown in the figure. Find the Miller indices and hence the inter-planar distance. Given the lattice constant 0.28 nm. 	2	2	**10**
	b)	Explain the principle, construction, working and applications of transmission electron microscope.	2	2	**10**
		OR			
4	a)	Highlight the significance of Braggs' equation in crystal structure determination. A beam of X-rays of wavelength 0.071 nm is diffracted by a plane of rock salt at (0 1 1) along the	2	2	**10**

			crystallographic axes (lattice constant of 0.3 nm). Find the glancing angle for the second-order diffraction.			
		b)	Explain the principle, construction, working and applications of scanning electron microscope.	*2*	*2*	**10**
			UNIT - III			
	5	a)	Explain the mechanism of an acid and a base catalyzed reactions by taking suitable examples.	*2*	*2*	**10**
		b)	Outline the preparation, properties and applications of zeolites as catalysts.	*3*	*6*	**10**
			OR			
	6	a)	Explain the significance of organometallic complexes as catalyst. Discuss the mechanism of hydrogenation of an alkene by a suitable organometallic catalyst.	*1*	*1*	**10**
		b)	What are the roles of catalytic converter in vehicles? Discuss the action of catalyst in catalytic converter.	*3*	*6*	**10**
			UNIT - IV			
	7	a)	What are azeotropes? Explain the phase diagram of high boiling and low boiling azeotropes with suitable examples.	*1*	*1*	**10**
		b)	With neat labelled sketch explain the phase diagram of lead-tin system.	*1*	*1*	**10**
			OR			
	8	a)	What is Nernst distribution law? To a container containing 100 mL of water and 10 mL of an organic solvent, 1 g of methylamine (CH_3NH_2) is added. Upon mixing, 0.6 g of methylamine is transferred to the organic layer. Calculate the partition coefficient between the organic solvent and water.	*2*	*2*	**10**
		b)	With neat labelled sketch explain the phase diagram of iron-iron carbide system.	*2*	*2*	**10**
			UNIT - V			
	9	a)	Explain the general properties and applications of ferrous alloys.	*1*	*1*	**7**
		b)	Explain the types of lubricants with examples.	*1*	*1*	**7**
		c)	Discuss the composition and applications of optical glass and polycarbonate glass.	*2*	*2*	**6**
			OR			
	10	a)	Discuss the manufacturing of soda glass.	*1*	*1*	**7**
		b)	Outline the composition of alloys for high temperature applications.	*2*	*2*	**7**
		c)	Elaborate on thick film lubrication mechanism.	*1*	*1*	**6**

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