Model Question Paper

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Course Code: 1BCHEC102/202

First Semester B.E. Degree Examination, January 2025

Applied Chemistry for Sustainable Structure and Material Design (Civil Stream)

TIME:3 hrs. Max.Marks:100

Note: 1. Answer any FIVE full questions, choosing ONE question from each MODULE
2. VTU Formula Handbooks Permitted
3. M: Marks, L: Bloom's level, C: Course outcomes.

		Module-1	M	L	C
Q.1	**a**	What are concentration cells? Derive an expression for potential of concentration cell.	6	L1	CO1
	b	Define fuel cell. Describe the construction, working and applications of solid-oxide fuel cell.	**7**	L2	CO1
	c	Apply electrochemical principles to describe the construction and working of a lithium-ion battery and evaluate its significance in modern energy storage and electric vehicle applications.	**7**	L3	CO1
		OR			
Q.2	**a**	Discuss construction, working and applications of redox flow battery.	6	L1	CO1
	b	Explain the following battery characteristics: i). Capacity ii) Power density iii) Cell balancing iv) Cycle life.	**7**	L2	CO1
	c	Describe the green hydrogen production by TiO_2 photo catalytical method and mention its applications.	**7**	L2	CO1
		Module–2			
Q.3	**a**	Describe the synthesis of TiO_2 nanoparticles by sol-gel method for sensor applications.	6	L2	CO2
	b	Explain synthesis, properties and engineering applications of chlorinated polyvinyl chloride (CPVC).	**7**	L2	CO2
	c	Discuss the preparation, properties and applications of carbon fibres.	**7**	L2	CO2
		OR			
Q.4	**a**	Explain the following size dependent properties of nanomaterials: i) Surface Area ii) Water absorption iii) Thermal Properties	6	L2	CO2
	b	In a polymer sample, 150 molecules have molecular weight of 10,000 g/mol, 300 molecules have molecular weight of 20,000 g/mol and 500 molecules have molecular weight 30,000 g/mol. Calculate number average and weight average molecular weight of the polymer.	**7**	L3	CO2
	c	Define adhesives. Explain the synthesis and application of epoxy resin.	**7**	L2	CO1

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Module–3					
Q.5	**a**	Describe the manufacturing process of cement by wet process with a neat diagram.	6	L2	CO3
	b	Explain the process of setting and hardening of cement with suitable reactions.	7	L2	CO3
	c	Explain synthesis, properties and applications of polylactic acid.	7	L2	CO3
OR					
Q.6	**a**	Discuss the working principle with chemical reactions and applications of spiropyran as photochromic coating.	6	L2	CO3
	b	What are piezoelectric cement composites? Discuss its applications in civil engineering.	7	L1	CO3
	c	Discuss the manufacturing process of geopolymer concrete.	7	L2	CO3
Module–4					
Q.7	**a**	Discuss the chemical compositions, properties and application of wrought- iron and cast-iron alloys.	6	L2	CO4
	b	A 4.3 Kg of iron metal piece of density 7.9 g/cm^3 with an area 15.0 inch^2 was submerged in sea water for 3 years. The weight of the remaining metal is found to be 3.0 Kg. Calculate CPR in mpy and mmpy.	7	L3	CO4
	c	Explain with neat diagram galvanization process for control the corrosion.	7	L2	CO4
OR					
Q.8	**a**	Discuss the chemical compositions, properties and application of Duralumin and Magnalium of Aluminum alloys.	6	L2	CO4
	b	Discuss electrochemical theory of corrosion taking iron as an example.	7	L2	CO4
	c	What is electroplating? Explain electroplating of chromium for hard and decorative coating.	7	L1	CO4
Module–5					
Q.9	**a**	Explain determination of total hardness of water by EDTA method.	6	L2	CO4
	b	Discuss the determination of dissolved oxygen by Winkler's method with suitable reactions.	**7**	L2	CO4
	c	In a COD test, 15 cm^3 and 10 cm^3 of 0.01 N FAS solution were required for blank and main titration respectively. The volume of test samples used is 25 cm^3. Calculate the COD of the sample.	**7**	L3	CO4
OR					
Q.10	**a**	Define COD. Explain the determination COD of effluent industrial wastewater samples by FAS method.	6	L1	CO4
	b	Describe the procedure for estimation of copper in brass by colorimetric sensor.	**7**	L2	CO4
	c	Discuss the principle, instrumentation and application in estimation of iron in industrial effluents by using a Potentiometric sensor.	**7**	L2	CO4

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