Model Question Paper

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Course Code: 1BCHEM102/202

First Semester B.E. Degree Examination, January 2025

Applied Chemistry for Advanced Metal Protection and Sustainable Energy Systems (ME Stream)

TIME: 3 hrs. Max.Marks:100

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

		Module-1	M	L	C
Q.1	**a**	What is electroplating? Explain its technological importance	6	L1	CO1
	b	What is corrosion? Explain electrochemical theory of corrosion by taking iron as an example.	7	L2	CO1
	c	A thick sheet of area 93 $inch^2$ is exposed to air near the ocean. After a 6 months it was found to experience a weight loss of 360 g due to corrosion, if the density of the steel is 7.9 g/cm^3. Calculate the corrosion penetration rate in mpy and mmpy (Given K = 534 in mpy and 87.6 mm/y)	**7**	L3	CO1
		OR			
Q.2	**a**	Explain the mechanisms behind waterline corrosion and pitting corrosion with neat diagrams.	6	L1	CO1
	b	Describe electro less plating of Nickel with chemical reactions involved in the process.	7	L2	CO1
	c	Explain and classify the methods of coating available for corrosion mitigation. With a neat labeled diagram illustrate the galvanization of Fe.	**7**	L2	CO1
		Module–2			
Q.3	**a**	Elucidate the construction and various parts of bomb calorimeter and explain its working principle.	6	L2	CO2
	b	Discuss the mechanism, adverse effects and steps taken to avoid petrol knocking. Mention with structures any two anti-knocking agents used.	**7**	L2	CO2
	c	What is power alcohol? Explain its properties, applications and its limitations.	**7**	L1	CO2
		OR			
Q.4	**a**	0.7g of a fuel containing 75% carbon, 2.5% hydrogen and rest is ash when burnt in bomb calorimeter increase the temperature of water from 27.3 °C to 29.1 °C, if the calorimeter contains 250g of water and its water equivalent is 150g. Calculate the GCV and NCV of the fuel.	6	L3	CO2
	b	Explain the process of production of green hydrogen by the photocatalytic water-splitting method and discuss the major advantages of this method.	**7**	L2	CO2
	c	Design an experimental process for synthesizing biodiesel by using the trans-esterification method. Explain its advantages and its applications.	**7**	L3	CO1

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		Module–3			
Q.5	**a**	Explain how size-dependent properties such as surface area, catalytic activity, electrical and thermal conductivity vary in nanomaterials	6	L2	CO3
	b	Describe the construction and working of Li ion battery with a neat labelled diagram , along with cell reactions.	7	L2	CO3
	c	Explain the synthesis of graphene by CVD method and comment on uses of CNT in energy devices.	7	L2	CO3
		OR			
Q.6	**a**	Explain the synthesis of TiO2 by sol gel method and mention its two uses.	6	L2	CO3
	b	Illustrate the construction, working and applications of solid oxide fuel cell (SOFC)	7	L2	CO3
	c	Explain the construction and working of solar photovoltaic (PV) cells and discuss their main advantages and limitations.	7	L2	CO3
		Module–4			
Q.7	**a**	Discuss synthesis, properties and engineering applications of chlorinated polyvinyl chloride (CPVC).	6	L2	CO4
	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	CO4
	c	Explain the synthesis process of polylactic acid (PLA) resin and discuss its important properties and applications.	7	L2	CO4
		OR			
Q.8	**a**	Explain how the structure of polymers influences their crystallinity and chemical resistivity with suitable examples.	6	L2	CO4
	b	Define glass transition temperature. State any three factors affecting Tg and comment on its significance.	7	L1	CO4
	c	Explain the synthesis of Kevlar and discuss its important properties along with major industrial applications.	7	L2	CO4
		Module–5			
Q.9	**a**	Define COD. Explain the determination COD of effluent industrial waste water samples by FAS method.	6	L1	CO4
	b	Explain the steps involved in the determination of viscosty coefficient of a high boiling organic coolant using Ostwald's viscometer.	**7**	L2	CO4
	c	Explain the principle of a conductometric sensor and discuss its application for estimating acid mixture in electrochemical bath effluent.	**7**	L2	CO4
		OR			
Q.10	**a**	In a COD test, 15 cm3 and 10 cm3 of 0.01 N FAS solution were required for blank and main titration respectively. The volume of test samples used is 25 cm3. Calculate the COD of the sample.	6	L3	CO4
	b	What is Lubricant? Discuss its properties and industrial applications.	**7**	L1	CO4
	c	Explain the use of glass electrode in the determination of pKa of weak acid using pH meter and state the equation which relates pH and pKa of a weak acids.	**7**	L2	CO4

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