Model Question Paper

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Course Code: 1BCHEE102/202

First Semester B.E. Degree Examination, January 2025

Applied Chemistry for Emerging Electronics and Futuristic Devices

(EEE 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 battery? Explain its classification	6	L1	CO1
	b	Explain the working principle of organic photovoltaic (OPV) cells with a neat schematic diagram and discuss their major applications in renewable energy systems.	7	L2	CO1
	c	Discuss the difference between organic and inorganic semiconductors.	7	L2	CO1
		OR			
Q.2	a	What is PV cell? Explain construction, working principal, advantages and limitations of solar photovoltaic cell (PV cell).	6	L1	CO1
	b	Explain the working principle and applications of Micro-electromechanical systems (MEMS)-based energy harvesters	7	L2	CO1
	c	Apply the electrochemical principles to explain the construction and working of a lithium-ion battery, and analyze its advantages for electric vehicle (EV) applications.	7	L3	CO1
		Module–2			
Q.3	a	What are Quantum dots (QDs)? Explain optical and electronic properties of quantum dots (QDs).	6	L1	CO2
	b	Explain synthesis of TiO_2 nanoparticles by sol-gel method and its uses in sensor applications	7	L2	CO2
	c	Discuss synthesis and properties of Graphene Quantum Dots using citric acid method and its applications in emerging electronics.	7	L2	CO2
		OR			
Q.4	a	Explain synthesis and properties of chitosan-carbon quantum dots hydrogel and its applications in next-generation flexible and wearable electronics	6	L2	CO2
	b	Explain synthesis, properties of silicon based QDs by sol gel method and Cd-Se Quantum Dots by hot injection 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

Module–3					
Q.5	**a**	What is polymer composite? Explain synthesis and properties of epoxy resin-magnetite (Fe₃O₄) composite from ultra-sonication method for sensors applications	6	L1	CO3
	b	Explain the synthesis, properties and applications of PDMS (Polydimethylsiloxane) and its uses in e-skin (electronic skin) and RFID applications.	7	L2	CO3
	c	Discuss the synthesis and properties of Kevlar Fiber Reinforced Polymer (KFRP) for smart electronic devices applications.	7	L2	CO3
OR					
Q.6	**a**	Describe the synthesis, conducting mechanism and electronic devices applications of Polyaniline.	6	L2	CO3
	b	Discuss basic principle and working of lithography for micro-patterned copper deposition	7	L2	CO3
	c	A polydisperse sample of polystyrene is prepared by mixing three monodisperse samples in the following proportions. 2g of 1000 molecular weight, 4g of 3000 molecular weight and 6g of 2000 molecular weight. Determine number average and weight average molecular weight. Find the index of polydispersity.	7	L3	CO3
Module–4					
Q.7	**a**	What is reference electrode? Explain construction, working and applications of calomel electrode	6	L1	CO4
	b	Discuss principle and instrumentation of potentiometric sensor	7	L2	CO4
	c	A copper concentration cell is obtained by combining two copper electrodes of concentrations 0.1M and 0.5 M immersed in copper sulphate solution at 25 ˚C. Write the cell reactions and calculate EMF of the cell.	7	L3	CO4
OR					
Q.8	**a**	Describe principle, instrumentation and application of colorimetric sensor in the estimation of copper in PCBs.	6	L2	CO4
	b	Explain the principle and instrumentation of conductometric sensor and its application in the estimation of acid mixture.	7	L2	CO4
	c	Apply electrochemical principles to explain the construction and working of a copper concentration cell, and calculate its EMF using the Nernst equation.	7	L3	CO4
Module–5					
Q.9	**a**	What is e-waste? explain the need for e-waste management	6	L1	CO4
	b	Apply the principles of electroplating to explain the process of chromium plating used for hard and decorative coatings.	7	L3	CO4
	c	What is CPR? A thick sheet of area 93 inch² 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/cm³. Calculate the corrosion penetration rate in mpy and mmpy (Given K = 534 in mpy and 87.6 mm/y)	7	L3	CO4
OR					
Q.10	**a**	What is electroplating? Explain technological importance of metal finishing	6	L1	CO4
	b	Explain electrochemical theory of corrosion by taking iron as an example.	7	L2	CO4

	c	Apply the concept of galvanization to prevent corrosion in steel structures exposed to marine environments. Justify your choice with appropriate chemical reasoning.	7	L3	CO4

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