

CBCS SCHEME

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1BCHEC102/202

First/Second Semester B.E./B.Tech. Degree Examination, June/July 2026

Applied Chemistry for Sustainable Structure & Material Design (CV)

Time: 3 hrs.

Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.

2. M : Marks, L: Bloom's level, C: Course outcomes.

3. VTU Formula Hand Book is permitted.

Module – 1			M	L	C
Q.1	a.	What are concentration cells? Two zinc electrodes are dipped in ZnSO ₄ solutions of concentrations 0.01 M and 0.5 M respectively at 25°C. Calculate the EMF of the cell.	6	L3	CO1
	b.	Describe the construction, working and applications of Silicon Solar Cell with a neat diagram.	7	L2	CO1
	c.	What are batteries? Briefly classify battery types with examples.	7	L2	CO1
OR					
Q.2	a.	Explain the construction, working and applications of a Solid Oxide Fuel Cell (SOFC).	6	L2	CO1
	b.	Describe the production of green hydrogen by photocatalytic water splitting using TiO ₂ catalyst. Mention its advantages.	7	L2	CO1
	c.	Explain the construction, working and applications of Lithium-ion battery.	7	L3	CO1
Module – 2					
Q.3	a.	What are Polymers? Explain different types of polymerization with suitable examples.	7	L2	CO2
	b.	A polydisperse polymer sample contains: 200 molecules of MW 15,000 g/mol; 400 molecules of MW 35,000 g/mol; and 100 molecules of MW 75,000 g/mol. Calculate the number average and weight average molecular weight of the polymer.	6	L3	CO2
	c.	Discuss the size-dependent properties of nanomaterials with respect to: (i) surface area, (ii) catalytic property, (iii) thermal properties	7	L2	CO2
OR					
Q.4	a.	Explain the synthesis, properties and engineering applications of Polymethyl Methacrylate (PMMA).	7	L2	CO2
	b.	Explain the synthesis of TiO ₂ nanoparticles by sol-gel method	6	L2	CO2
	c.	Discuss the composition of nanoconcrete. Explain the role of graphene and carbon nanotubes as fillers in carbon-based reinforced composites and their industrial significance.	7	L2	CO2
Module – 3					
Q.5	a.	Describe the manufacturing process of cement by the wet process with a neat flow diagram.	6	L2	CO3
	b.	Write the composition of Ordinary Portland Cement. Explain the process of setting and hardening of cement with suitable chemical reactions.	7	L2	CO3

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Q.5	c.	What is geopolymer concrete? Explain the manufacturing process of geopolymer concrete.	7	L2	CO3
OR					
Q.6	a.	Discuss the different types of cements — their composition, properties and applications.	6	L2	CO3
	b.	Explain the working principle of spiropyran as a photochromic coating with relevant chemical reactions and its applications in construction.	7	L2	CO3
	c.	Explain the synthesis, properties and applications of Polylactic Acid (PLA).	7	L2	CO3
Module – 4					
Q.7	a.	What is corrosion? Explicate the electrochemical theory of corrosion of steel in concrete with neat anodic and cathodic reactions.	7	L2	CO4
	b.	Discuss the composition, properties and applications of: (i) wrought iron and (ii) pig iron.	6	L2	CO4
	c.	A steel pipe (density = 7.9 g/cm ³) of surface area 200 inch ² was exposed to a corrosive environment for 2 years and lost 600 g of material. Calculate the CPR in: (a) mpy (b) mm/year.	7	L3	CO4
OR					
Q.8	a.	Discuss the technological importance of metal finishing processes in modern engineering. Explain electroplating of chromium for hard applications.	7	L2	CO4
	b.	Discuss the chemical composition, properties and applications of Duralumin and Magnalumin aluminium alloys.	6	L2	CO4
	c.	What is galvanization? Describe galvanization process to control corrosion.	7	L2	CO4
Module – 5					
Q.9	a.	Explain the determination of total hardness of water by the EDTA method.	7	L2	CO4
	b.	Discuss the principle, instrumentation and application of a Potentiometric sensor in the estimation of iron in industrial effluents.	6	L2	CO4
	c.	Define Chemical Oxygen Demand (COD). In a COD test, 25 cm ³ of wastewater was mixed with 10 cm ³ of K ₂ Cr ₂ O ₇ . The unreacted K ₂ Cr ₂ O ₇ required 12.5 mL of 0.3 N FAS solution. In a blank titration, 10 cm ³ of K ₂ Cr ₂ O ₇ required 18.0 mL of 0.3 N FAS. Calculate the COD of the wastewater sample.	7	L3	CO4
OR					
Q.10	a.	Highlight the significance of the following water quality parameters for environmental and construction applications: (i) pH, (ii) turbidity, (iii) chlorides, and (iv) alkalinity.	7	L2	CO4
	b.	Explain the instrumentation and application of a Colorimetric sensor in the estimation of copper in brass alloy.	6	L2	CO4
	c.	100 cm ³ of a hard water sample required 22 cm ³ of 0.01 M EDTA solution for titration. Upon boiling and filtering, the same 100 cm ³ sample required 10 cm ³ of 0.01 M EDTA. Calculate the total, permanent and temporary hardness of the water sample in mg/L as CaCO ₃ .	7	L3	CO4
