U.S.N.										

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

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

Programme: B.E. **Semester: IV**

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

Course Code: 23CH4ESANI / 22CH4PCANI **Max Marks: 100**

Course: Analytical Instruments

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)		Define analysis from an analytical perspective. Differentiate between qualitative and quantitative analysis.	*CO1*	*PO 1*	**05**
	b)		Discuss the classification of instruments based on elemental analysis.	*CO1*	*PO1*	**05**
	c)		Explain the steps involved in the external standard calibration method in detail.	*CO2*	*PO1*	**10**
			OR			
2	a)		Differentiate between determinative and indeterminate errors with examples.	*CO1*	*PO1*	**05**
	b)		Explain the concept of accuracy and precision with suitable examples.	*CO1*	*PO1*	**05**
	c)		Explain the steps involved in the internal standard calibration method in detail.	*CO2*	*PO1*	**10**
			UNIT - II			
3	a)		What are the three types of electrons involved in UV absorption? Explain.	*CO2*	*PO1*	**05**
	b)		Discuss the mechanism of electronic transitions in organic molecules in detail, illustrating them on an energy level diagram.	*CO2*	*PO1*	**10**
	c)		A solution of chemical ‘A’ having its 0.14 mol/L concentration has an absorbance of 0.42. Another solution of ‘A’ under same conditions has an absorbance of 0.6. What is the concentration of this solution of ‘A’? Identify the instrument used.	*CO3*	*PO5*	**05**

			OR			
	4	a)	Explain the working of UV-vis spectroscopy with a labelled diagram.	*CO1*	*PO1*	**10**
		b)	Differentiate between functional group region and fingerprint region in an FTIR spectrum.	*CO2*	*PO2*	**04**
		c)	Discuss the factors influencing the absorption of infrared radiation in IR spectroscopy.	*CO2*	*PO2*	**06**
			UNIT - III			
	5	a)	Analyze the thermal decomposition of calcium oxalate monohydrate ($CaC_2O_4.H_2O$) and sketch a thermogram showing decomposition ranges at 100-226 °C, 346-420 °C and 600-840 °C.	*CO2*	*PO2*	**10**
		b)	Explain the principle and working of thermogravimetry analysis (TGA) with a suitable diagram.	*CO3*	*PO5*	**10**
			OR			
	6	a)	Explain the principle and working of Bomb Calorimeter (BC) with a labelled diagram.	*CO2*	*PO1*	**10**
		b)	12.2 g solid benzoic acid is combusted in bomb calorimeter at 27 °C. Temperature rises to 77 °C. If the heat capacity of calorimeter is 50 $J/^0C$. Calculate change in internal energy per mole. Calculate the molar enthalpy of combustion at 27 °C.	*CO3*	*PO5*	**10**
			UNIT - IV			
	7	a)	Differentiate between mobile phase and stationary phase in gas chromatography.	*CO1*	*PO1*	**04**
		b)	Explain split injection method used in gas chromatography (GC).	*CO2*	*PO1*	**06**
		c)	Explain the principle and working of gas chromatography (GC) with a suitable diagram.	*CO3*	*PO5*	**10**
			OR			
	8	a)	Explain split-less injection method used in gas chromatography (GC).	*CO2*	*PO1*	**06**
		b)	How is a component identified by retention time in gas chromatography (GC)?	*CO3*	*PO5*	**04**
		c)	List the types of detectors used in gas chromatography (GC) and explain the working of any one in detail with a neat sketch.	*CO43*	*PO5*	**10**
			UNIT - V			
	9	a)	In a normal-phase column HPLC system, the operator has three solvent choices: acetone, acetonitrile, and hexane. Which solvent would you select as the mobile phase and why?	*CO3*	*PO5*	**05**

		b)	Draw a neat, labelled diagram of High-Performance Liquid Chromatography (HPLC).	*CO3*	*PO5*	**05**
		c)	Enlist the types of detectors used in HPLC and explain the working of any one in detail with a neat sketch.	*CO3*	*PO5*	**10**
			OR			
	10	a)	List the criteria for selecting a mobile phase in HPLC.	*CO3*	*PO5*	**05**
		b)	Explain the reverse-phase column used in HPLC.	*CO3*	*PO5*	**05**
		c)	Explain the principle and working of High-Performance Liquid Chromatography (HPLC) with a suitable diagram.	*CO3*	*PO5*	**10**

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