Reg. No.															

Question Paper Code	13985

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025

Fifth Semester

Electronics and Instrumentation Engineering

(Common to Instrumentation and Control Engineering)

20EIPC501 - ANALYTICAL INSTRUMENTATION

Regulations - 2020

Duration: 3 Hours | Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	The Beer–Lambert law relates absorbance to: (a) Concentration and temperature (b) Concentration and path length (c) Wavelength and transmittance (d) Wavelength and frequency	1	K2	CO1
2.	Which detector is commonly used in UV-Visible spectrophotometers? (a) Thermocouple (b) Photodiode (c) Flame photometer (d) Bolometer	1	K1	CO1
3.	In gas chromatography, the mobile phase is: (a) Liquid (b) Gas (c) Solid (d) Gel	1	K2	CO2
4.	The separation of solutes in chromatography depends mainly on differences in: (a) Mass (b) Density (c) Partition coefficients (d) Temperature	1	K2	CO2
5.	The gas analyzer used for detecting carbon monoxide is based on: (a) Thermal conductivity (b) Infrared absorption (c) Ionization potential (d) Chemical titration	1	K2	CO3
6.	The pollutant responsible for acid rain among the following is: (a) Oxygen (b) Nitrogen (c) Sulphur dioxide (d) Methane	1	K2	CO3
7.	The pH electrode is commonly made of: (a) Platinum (b) Silver (c) Glass (d) Carbon	1	K1	CO4
8.	A dissolved oxygen analyzer measures: (a) Total suspended solids (b) Oxygen concentration in water (c) Chemical oxygen demand (d) Conductivity of solution	1	K1	CO4
9.	In NMR spectroscopy, the nuclei absorb energy from which region of the electromagnetic spectrum? (a) Microwave (b) Infrared (c) Radio frequency (d) Ultraviolet	1	K1	CO5
10.	The purpose of the ionization chamber in a mass spectrometer is to: (a) Detect photons (b) Separate isotopes (c) Produce charged particles (d) Measure atomic weight directly	1	K1	CO5

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

		Marks	K – Level	CO
11.	State the Beer–Lambert law and mention its significance in spectrophotometry.	2	K1	CO1
12.	Distinguish between UV-Visible and IR spectrophotometry based on wavelength range and detector type.	2	K2	CO1
13.	List the main components of a gas chromatograph and their functions.	2	K1	CO2
14.	Compare gas chromatography and liquid chromatography in terms of mobile phase and application.	2	K2	CO2
15.	Name any two gases commonly monitored in industrial pollution control systems.	2	K1	CO3
16.	Summarize how thermal conductivity detectors are used for gas analysis.	2	K2	CO3
17.	Describe how a sodium analyzer helps in assessing water quality.	2	K2	CO4
18.	Identify the electrodes used in a pH meter and their roles.	2	K1	CO4
19.	Classify ionization methods used in mass spectrometry.	2	K2	CO5

20.	Define chemical shift in NMR and mention its importance.	*2*	*K1*	*CO5*
21.	State the purpose of a reference electrode in a pH measurement system.	*2*	*K1*	*CO4*
22.	Differentiate between IR analyzers and chemical analyzers used for gas detection.	*2*	*K2*	*CO3*

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

23.	a)	Explain the IR spectrophotometric techniques to identify functional groups in an unknown organic sample.	*11*	*K2*	*CO1*
		OR			
	b)	Demonstrate the steps involved in calibration of a UV-Visible spectrophotometer for accurate absorbance measurement.	*11*	*K2*	*CO1*
24.	a)	Illustrate the classification of chromatographic methods and their general working principles.	*11*	*K2*	*CO2*
		OR			
	b)	Describe the role of stationary and mobile phases in determining solute retention.	*11*	*K2*	*CO2*
25.	a)	Expalin about the performance differences between optical and electrochemical sensors for pollutant measurement.	*11*	*K2*	*CO3*
		OR			
	b)	Differentiate various air pollution monitoring instruments used for particulate and gaseous pollutants.	*11*	*K2*	*CO3*
26.	a)	Describe the working of a pH meter with reference to electrode potentials and buffer calibration.	*11*	*K2*	*CO4*
		OR			
	b)	Outline the principles of conductivity and dissolved oxygen measurement.	*11*	*K2*	*CO4*
27.	a)	Enumerate the NMR techniques to identify structural differences between isomeric organic compounds.	*11*	*K2*	*CO5*
		OR			
	b)	Illustrate how the mass spectrometric data was used to determine the molecular weight and fragmentation pattern of a compound.	*11*	*K2*	*CO5*
28.	a)	Summarize the working principles of infrared and thermal conductivity gas analyzers.	*11*	*K2*	*CO3*
		OR			
	b)	Describe the need for continuous emission monitoring systems in industries.	*11*	*K2*	*CO3*