

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2024

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) (20 × 1 = 20 Marks)

Answer ALL Questions

| | Marks | K- Level | CO |
|--|-------|-------------|-----|
| 1. Number of waves spread in a length of one centimeter is (a) Wave number (b) Frequency (c) Velocity (d) Wavelength | 1 | K1 | CO1 |
| 2. ----- used to measure low intensities of illumination. (a) Photovoltaic cell (b) Photometer (c) Photo emissive tubes (d) Photo multiplier tubes | 1 | K1 | CO1 |
| 3. The most widely used radiation source in UV regions of the spectrum under low pressure is (a) Hydrogen lamp (b) Tungsten lamp (c) Mercury lamp (d) Xenon lamp | 1 | K1 | CO1 |
| 4. Beam splitter in spectrophotometers splits light source in the ratio of (a) 50:50 (b) 75:25 (c) 25:75 (d) 60:40 | 1 | K1 | CO1 |
| 5. ----- used to remove gas in the liquid flow in liquid chromatography. (a) Filter (b) Pulse damper (c) Burner (d) Degasser | 1 | K1 | CO2 |
| 6. Chromatography technique applied for thermally unstable substances is (a) Gas-solid chromatography (b) Gas-Liquid chromatography (c) Liquid chromatography (d) High Pressure Liquid Chromatography | 1 | K1 | CO2 |
| 7. Moderate flow rates in pumps for HPLC is (a) 0.5-2 ml/ min (b) 0.1-0.5 ml/ min (c) 0.5-1 ml/ min (d) 0.1-1 ml/ min | 1 | K1 | CO2 |
| 8. Indicate the detector which is not applicable for gas chromatography (a) Flame ionization detectors (b) Thermal conductivity detectors (c) Photo multiplier tube (d) Electron capture detector | 1 | K1 | CO2 |
| 9. Identify the gas which is more paramagnetic in nature (a) Oxygen (b) Nitric oxide (c) Nitrogen dioxide (d) Sulphur dioxide | 1 | K1 | CO3 |
| 10. Standard method for measurement of CO is (a) Colorimetry (b) NDIR spectroscopy (c) Coulometry (d) Flame photometry | 1 | K1 | CO3 |
| 11. The major hydrocarbon emitted into atmosphere by natural activities is (a) Ethylene (b) Methane (c) Propylene (d) Butane | 1 | K1 | CO3 |
| 12. Increase in ----- concentration affects transpiration of trees causing chlorosis and dwarfing. (a) SO ₂ (b) NO ₂ (c) CO (d) HCL | 1 | K1 | CO3 |
| 13. In dissolved oxygen analyser, the water to be analysed is maintained at a temperature of around (a) 30-35°C (b) 25-30°C (c) 20-25°C (d) 15-20°C | 1 | K1 | CO4 |
| 14. Fluorocarbon membrane in gas sensing electrode is used to detect (a) CO ₂ (b) Ammonia (c) Fluorine (d) Potassium | 1 | K1 | CO4 |
| 15. Corrosion rates and precipitation of a solution is determined using (a) Glass electrode (b) Calomel electrode (c) Ion selective electrode (d) Gas sensing electrode | 1 | K1 | CO4 |
| 16. pH of the sample solution is determined by the equation (a) - log ₁₀ [H ⁺] (b) log ₁₀ [H ⁺] (c) - log ₁₀ [H ⁻] (d) log ₁₀ [H ⁻] | 1 | K1 | CO4 |

17. Identify the compound that acts as ionizing gas in Geiger Muller counter. 1 K1 CO5
 (a) Alcohol (b) Argon gas (c) Krypton (d) Hydrogen
18. The crystal used as X-ray grating has _____ dimensional lattice arrays. 1 K1 CO5
 (a) One (b) Two (c) Three (d) Four
19. The reduction in counting efficiency of the scintillation detector is called as _____. 1 K1 CO5
 (a) Disintegration (b) Decay (c) Quenching (d) Reduction
20. NMR is the study of the absorption of _____ by nuclei in a magnetic field. 1 K1 CO5
 (a) Radioactive radiation (b) IR radiation (c) Radio frequency radiation (d) Microwaves

PART - B (10 × 2 = 20 Marks)

Answer ALL Questions

21. State Beer Lambert law. 2 K1 CO1
22. Compare Filters and Monochromators based on its function. 2 K1 CO1
23. Classify the four main functions involved in chromatography. 2 K1 CO2
24. List the three types of pump used in High Pressure Liquid Chromatography. 2 K1 CO2
25. Name the four types of Industrial Emission Monitoring system in NO₂ analyzer. 2 K2 CO3
26. List any two applications of IR analyzer. 2 K1 CO3
27. Differentiate between Oxidation and Reduction with an suitable chemical reaction. 2 K2 CO4
28. Indicate the two ways by which the efficiency of the Sodium analyzer can be improved. 2 K2 CO4
29. Classify the four different types of Mass Spectrometer. 2 K1 CO5
30. Indicate the two special methods used for scanning spectrum in NMR Spectrometer. 2 K2 CO5

PART - C (6 × 10 = 60 Marks)

Answer ALL Questions

31. a) Explain the construction and working principle of Michelson Interferometer based Fourier Transform Infra-Red Spectrometers with suitable diagram. 10 K2 CO1
OR
 b) Illustrate the working principle of Atomic Absorption spectroscopy with necessary diagram. 10 K2 CO1
32. a) Draw and explain the instrumentation of HPLC in detail. 10 K2 CO2
OR
 b) Draw the schematic diagram of gas chromatography and explain the components in detail. 10 K2 CO2
33. a) Discuss about Dust and smoke measurement with neat sketch. 10 K2 CO3
OR
 b) Outline the working principle of below techniques used for both qualitative and quantitative analysis of organic compounds.
 (i) Single Beam IR analyzer
 (ii) Double Beam IR analyzer 10 K2 CO3
34. a) Compare the standard Hydrogen and Calomel electrodes for determining the pH of the chemical solution based on its construction and working principle with necessary chemical equations. 10 K2 CO4
OR
 b) Illustrate the working principle of silica analyzer for determining the amount of Silica content present in the given solution. 10 K2 CO4

35. a) With neat Sketch explain various components of Mass spectrometer. 10 K2 CO5

OR

b) Demonstrate the construction and working principle of NMR based spectrometers with neat sketch. 10 K2 CO5

36. a) Explain the principle of sodium analyzer in detail. 10 K2 CO4

OR

b) With a neat sketch explain the working principle of UV visible spectrophotometer in detail. 10 K2 CO1