No. of Printed Pages : 4

MCH–003

POST GRADUATE DIPLOMA IN ANALYTICAL CHEMISTRY (PGDAC)

Term-End Examination

December, 2023

MCH-003 : SPECTROSCOPIC METHODS

Time : 3 Hours *Maximum Marks : 75*

Note : *Attempt any* ***five*** *questions. All questions carry equal marks.*

1. (a) Explain the term refraction with the help of a diagram and explain Snell's law. 5

   (b) Draw normal modes of vibrations of a linear and angular triatomic molecule AB_2 schematically. 5

   (c) Explain the term Index of Hydrogen Deficiency (IHD). Calculate the IHD for C_4H_4 and $C_5H_{16}O$. 5

2. (a) Describe line spectrum, band spectrum and continuous spectrum. Draw their origin schematically. 5

   (b) Write down the equation for Beer-Lambert's law, explaining all the terms. Write any *two* deviations observed in this law. 5

   (c) What are monochromators ? Describe the functioning of a monochromator. 5

3. (a) Write the wavelengh/wave number ranges of near IR, mid-IR and far-IR regions. What is the advantages of far-IR spectrometer ? 5

   (b) Write the *two* main issues in Raman spectroscopy. List the basic components of a Raman spectrometer. 5

   (c) State Franck-Condon's principle. Describe in brief the non-radiative or radiative types of deactivation processes. 5

4. (a) Explain Stokes shift. Why does the fluorescence occur at longer wavelengths than absorption ? 5

(b) Define fluorescence quenching. Write the Stern-Volmer equation and explain the terms involved in it. 5

(c) How is fluorescence spectroscopy helpful in the qualitative and quantitative analysis of inorganic analytes ? 5

5. (a) Give any *five* salient features of analysis by flame photometry. 5

(b) Describe the room temperature phosphorescence method in chemical analysis. 5

(c) Name the parameters of atomic spectrum and explain any *two*. 5

6. (a) Discuss the role of flame atomizer and nebulizer in flame photometry. 5

(b) Write the reasons of using argon as the plasma gas in all the types of plasma sources in AES. 5

(c) Explain various types of interferences encountered in atomic fluorescence spectrometry. 5

7. (a) Write any *three* fuel-oxidant combinations commonly used in AAS. What is the role of monochromator ? 5

   (b) Write the precautions that should be observed while preparing samples for AAS and AES. 5

   (c) Write the application of AAS in the determination of cadmium in biological samples. 5

8. (a) Define chemical shift. Explain why tetramethyl silane is used as standard for chemical shift measurement. 5

   (b) Explain why aprotic solvent is preferred for recording NMR spectra of organic compounds. Name any *three* commonly used organic solvents. 5

   (c) What do you understand by fragmentation of organic molecules in mass spectrum ? Explain the McLafferty rearrangement. 5