No. of Printed Pages : 5 **MCH–003**

P. G. DIPLOMA IN ANALYTICAL CHEMISTRY (PGDAC)

Term-End Examination

June, 2025

MCH-003 : SPECTROSCOPIC METHODS

Time : 3 Hours *Maximum Marks : 75*

Note : *(i) Answer any* ***five*** *questions.*

(ii) All questions carry equal marks.

1. Answer any *three* of the following :

   (a) What are the characteristics of EM radiation ? Give its relationship with wavelength. 5

   (b) Draw a diagram to depict phenomenon of refraction of radiation. Explain Snell's law of refraction. 5

(c) Draw a schematic diagram for a single beam UV-Vis spectrometer. Distinguish single beam and double beam spectrometers. 5

(d) Explain standard solution method for determination of concentration of unknown solution. 5

(e) What is the selection rule for the vibrational spectroscopy ? Explain fundamental vibration, first overtone, and the second overtone. 5

2. (a) Discuss in brief any *two* categories of transducers employed for detecting IR radiation. 5

(b) Explain Stokes and anti-Stokes lines in Raman spectroscopy. 5

(c) Give a brief account of surface enhanced Raman scattering. 5

3. (a) Draw the Jablonski diagram showing the phenomenon of fluorescence and phosphorescence. 5

   (b) Explain internal conversion and intersystem crossing. 5

   (c) Describe the method of determination of atmospheric pollutants NO-NO_2. 5

4. (a) What is the principle of flourimetry ? Discuss its application in the determination of blood glucose. 5

   (b) Give differences between Atomic Absorption Spectrometry (AAS) and Atomic Emission Spectrometry (AES). 5

   (c) Illustrate the processes involved when a sample is subjected to any hydrogen flame. 5

5. (a) Explain the principle of atomic fluorescence spectrometry. 5

(b) Draw a schematic energy level diagram showing the excitation and de-excitation processes involved in origin of the following : 5

(i) Double resonance fluorescence

(ii) Thermally assisted fluorescence

(c) What is the role of flame atomiser in flame photometry ? Discuss briefly its components. 5

6. (a) How Sr and La help in minimising phosphate interference in the quantitative determination of calcium by atomic absorption spectrophotometry ? 5

(b) Give any *five* characteristics expected of an ideal atomization-excitation source. 5

(c) Draw a schematic diagram of different components of an Inductively Coupled Plasma (ICP). 5

7. (a) What precautions should be observed while preparing samples for AAS and AES ? 5

(b) Describe the graphite furnace used in flameless Atomic Absorption Spectrophotometer (AAS). 5

(c) Explain spin-lattice relaxation and spin-spin relaxation. 5

8. (a) What is the full form of TMS ? Why is TMS used as the reference solvent in NMR spectroscopy ? 5

(b) Draw the mass spectrum of methanol and explain the 'base peak' and 'isotopic peaks'. 5

(c) Discuss McLafferty rearrangement to explain the peak observed at m/z 44 in the mass spectrum of butanal. 5

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