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**MCH-003**

**P. G. DIPLOMA IN ANALYTICAL  
CHEMISTRY (PGDAC)**

**Term-End Examination**

**June, 2025**

**MCH-003 : SPECTROSCOPIC METHODS**

*Time : 3 Hours*

*Maximum Marks : 75*

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

(ii) All questions carry equal marks.

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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

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- (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<sub>2</sub>. 5
4. (a) What is the principle of fluorimetry ? 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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