

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

**Term-End Examination**

**December, 2018**

**MCH-003 : SPECTROSCOPIC METHODS**

*Time : 3 hours*

*Maximum Marks : 75*

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

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1. Answer the following :

5×3=15

- (a) Draw a general MO energy level diagram for organic molecules and show the possible transitions.
- (b) Green light has wavelength 535 nm. Calculate its energy. ( $h = 6.625 \times 10^{-34}$  Js)
- (c) What are isotopic peaks ? Give their utility in mass spectrometry.
- (d) What is Pascal's triangle ? Give its significance.
- (e) What is meant by absorption maxima ? Give its importance.

2. (a) Draw a schematic sketch of a double beam spectrophotometer. What are the sources of radiation for UV – VIS regions of the spectrum ? 5
- (b) How is Fourier-Transform Infrared Spectrometer (FTIR) different from Infrared Spectrometer (IR) ? Give the advantages of FTIR Spectrometer. 5
- (c) Explain the theory of Raman spectroscopy. What is meant by Raman shift ? 5
3. (a) Differentiate between phosphorescence and fluorescence with the help of Jablonski diagram. 5
- (b) Explain fluorescence quenching and give the Stern-Volmer equation. Which type of atoms/molecules show quenching ? 5
- (c) Explain how fluorescence is useful in mineral analysis. Write any two crystallophosphors that are used in the analysis of metal ions. 5
4. (a) Explain the basic principle of atomic spectroscopic methods. Give the schematic representation of the transitions involved in these. 5
- (b) Draw the structure of flame showing various zones. Explain the reactions that occur in the flame considering a molecule MX. 5
- (c) Explain internal standard method used in flame photometric determination. 5

5. (a) Describe hollow cathode lamp (HCL) with the help of schematic diagram, illustrating different components. Explain how electrodeless discharge lamp (EDL) is better than HCL. 5
- (b) Discuss various interferences encountered in Atomic Fluorescence Spectrometry (AFS). Give any one advantage and one disadvantage of the method. 5
- (c) Discuss the role of atomiser and monochromator in atomic absorption spectrophotometry. 5
6. (a) What is the use of organic solvents during sample preparation for AAS ? Discuss its advantages over acidic solvents. 5
- (b) What are the various types of interferences encountered in atomic absorption spectrophotometry ? Explain how these are eliminated or minimized especially for phosphate interference in the determination of calcium by AAS. 5
- (c) Explain the principle of atomic emission spectrometry. How can plasma based sources be used in AES ? 5

7. (a) Discuss the analytical methodology in ICP-AES with emphasis on quantitative analysis. Explain the characteristic features of calibration plots. 5
- (b) Discuss the rationale behind the choice of Ar used as the plasma gas. Show the temperature profile of a typical ICP torch. 5
- (c) Explain various types of interferences encountered in ICP-AES. Discuss the advantages offered by the technique of ICP-AES as compared to AAS. 5
8. (a)  $\text{Si}(\text{CH}_3)_4$ , Tetramethylsilane, is most ideally suited as standard chemical shift ( $\delta$ ). Explain. 3
- (b) Explain the origin of isotopic peaks by considering the example of  $\text{CH}_3\text{Br}$ . 4
- (c) Explain the NMR spectrum of ethanol ( $\text{C}_2\text{H}_5\text{OH}$ ) in low resolution and high resolution conditions. How and why is it different? Also predict the mass spectral features of this molecule. 8
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