

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

**Term-End Examination**

00821

**December, 2017**

**MCH-003 : SPECTROSCOPIC METHODS**

*Time : 3 hours*

*Maximum Marks : 75*

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**Note : Answer *five* questions in all. Question no. 1 is compulsory.**

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1. Answer any *five* of the following :  $5 \times 3 = 15$

- (a) What are the main signals of the pure vibrational spectrum of a diatomic molecule ?
- (b) Explain the mull technique for handling a solid sample in IR spectroscopy.
- (c) Explain fluorescence quenching with the help of an example.
- (d) Describe in brief, the principle of atomic fluorescence spectrometry.
- (e) How is a sample prepared for atomic absorption spectrophotometry ?
- (f) Draw a low and high resolution NMR spectra of ethanol.

2. (a) Name the additional bands arising out of the fundamental frequencies and corresponding overtones in the IR spectra of polyatomic molecules. 5
- (b) What is Fingerprint Region ? How is the IR spectra used to check the authenticity of a compound ? 5
- (c) What is Photoluminescence ? How is it related to the structure of a molecule ? 5
3. (a) Draw the schematic layout of a fluorimeter. How is it different from absorption spectrometer ? 5
- (b) What is meant by anti-Stokes fluorescence ? Draw its schematic energy level diagram. 5
- (c) Draw the structure of a flame showing different zones. Which of the zones is most oxidising ? 5
4. (a) What are the advantages and disadvantages of Microwave Induced Plasma (MIP) over Inductively Coupled Plasma (ICP) ? 5
- (b) Discuss the merits of AAS and write any two of its limitations. 5

- (c) NMR spectrum of an organic compound with molecular formula  $C_4H_7BrO_2$  recorded using TMS as a standard gives a triplet, a quartet and a triplet at  $\delta = 1.2, 2.1$  and  $4.2$  ppm, respectively. In addition, a sharp peak is observed at  $\delta = 11$ . Predict the structure of the compound. 5
5. (a) Describe in brief, the Resonance Raman Spectroscopy (RRS). 5
- (b) Draw a schematic labelled diagram of the experimental set-up of a dispersion Raman spectrometer. 5
- (c) Explain extractive fluorimetry with the help of suitable examples. 5
6. (a) Why is phosphorescence measured in viscous media or from molecules absorbed on solid surfaces? Why is it preferred to degas the solution prior to measuring its phosphorescence? 5
- (b) What are the most important reactions that occur in the flame during flame photometry? 5
- (c) What are the different types of plasma sources in atomic emission spectrometry? Write the advantages of any one of the sources. 5

7. (a) Describe how ICP-AES is used for quantitative analysis. Draw a typical calibration plot for this. 5
- (b) Compare the characteristic features of AAS and AES and discuss their advantages over one another. 5
- (c) Write the characteristic features of a mass spectrum. 5
8. (a) What is the origin of isotopic peaks in the mass spectrum of a molecule ? Discuss in brief, the applications of mass spectrometry. 5
- (b) Describe the methodology followed for quantitative determinations using the uv-visible spectrophotometry. 5
- (c) Discuss the quantitative applications of flame photometry with the help of suitable examples. 5
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