

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

**Term-End Examination**

00187

**June, 2015**

**MCH-003 : SPECTROSCOPIC METHODS**

*Time : 3 hours*

*Maximum Marks : 75*

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

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1. Answer any *five* of the following : *5×3=15*
- (a) State the principle of fluorimetric determination of blood glucose.
  - (b) Distinguish between fluorescence and phosphorescence.
  - (c) Enumerate the advantages of FT-IR spectrometer over its dispersive counterpart.
  - (d) Explain, why simultaneous multi-elemental determination by ICP – AES is easier as compared to that by AAS.
  - (e) How many signals do you expect in the  $^1\text{H}$  – NMR spectra of 2-bromopropane and 1-bromopropane ?

- (f) Calculate the population of an energy level having energy of 2 kJ/mol relative to the energy at ground state at 300 K.
2. (a) What do you understand by the term fluorescence quenching ? Discuss the mechanisms of fluorescence quenching. 5
- (b) Discuss the different mechanisms of non-radiative relaxations of an excited electronic state. 5
- (c) Explain the basis of qualitative and quantitative analysis by flame photometry. 5
3. (a) What are the distinctive advantages of fluorescence spectroscopy over uv-visible spectrophotometry ? 5
- (b) Discuss the merits and limitations of flame photometry. 5
- (c) Explain the basic principle of atomic fluorescence spectrometry. What are the major components of instrumentation involved in AFS ? 5
4. Justify any *three* of the following statements : 3×5=15
- (a) The magnitude of a chemical shift is proportional to the strength of the induced magnetic field generated by the circulation of surrounding electrons about the proton.
- (b) TMS is used as an internal standard for measuring chemical shifts in organic compounds.

- (c) Atomic emission is more sensitive to flame instability than atomic absorption.
- (d) Raman shift positions of Stokes and Anti-Stokes lines are equal but opposite.
- (e) Inductively coupled plasma are suitable for atomic emission spectrometry.
5. (a) What do you understand by GFAAS ? Discuss the advantages and disadvantages of GFAAS. 5
- (b) How does phosphate interfere in the quantitative determination of calcium by atomic absorption spectrometry ? 5
- (c) What do you understand by matrix modifier ? What is its importance ? 5
6. (a) Enlist the different types of plasma sources used for atomic absorption spectrometry. State the sources of their energies. 5
- (b) Briefly describe the working of a polychromator. 5
- (c) What precautions should be observed while preparing samples for AAS ? 5
7. (a) Which of the following nuclei will be NMR active and why ?  
 $^{19}\text{F}$  ;  $^{13}\text{C}$  ;  $^{16}\text{O}$  ;  $^{12}\text{C}$ . 5

- (b) Why can protic solvents not be used to record the PMR spectrum of an organic compound? 5
- (c) Draw a labelled schematic diagram of an NMR spectrometer showing various components. 5
8. (a) Explain McLafferty rearrangement in mass spectrometry. 3
- (b) Calculate the IHD for any *two* of the following compounds : 4
- (i)  $C_4H_4$
- (ii)  $C_5H_{10}O$
- (iii)  $C_6H_{12}O_6$
- (c) A compound having the formula  $C_7H_6O$ , showed the following spectral data : 8
- IR : Strong band at  $1700\text{ cm}^{-1}$
- NMR :  $\delta\ 7.4 - 7.9$ , multiplet, 5H  
 $\delta\ 9.8$ , singlet, 1H
- Mass : Peak at  $m/z = M^+$  106, 105, 77, 51.
- Determine the structure of the molecule and assign the signals.
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