

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

Term-End Examination

June, 2011

MCH-003 : SPECTROSCOPIC METHODS

Time : 3 hours

Maximum Marks : 75

Note : Answer five questions in all. Question number 1 is compulsory.

1. Answer *any five* of the following : 5x3=15
- (a) What is meant by a spectrum ? Differentiate between a continuous spectrum and a line spectrum.
 - (b) What are the types of electronic transitions observed when an organic molecule absorb ultraviolet radiations ? Give examples.
 - (c) What are the advantages of FT-IR instruments over dispersive instruments ?
 - (d) Define sensitised fluorescence. What is its significance ?
 - (e) List different factor's that contribute to the width of atomic spectral lines. How can the width be decreased ?
 - (f) What is the principle of mass spectrometry ? In what way is it different from other spectrometre methods ?

2. (a) What are monochromators? How are these better than colour filters? Describe the working of a grating monochromator.
- (b) The acetylene molecule has a characteristic absorption at 2200cm^{-1} in the IR spectrum. Calculate the energy and frequency of the IR radiation absorbed by acetylene.
- (c) What is meant by the degree of depolarisation of a signal in Raman spectrum? What is its significance? **3x5=15**
3. (a) The fluorescence of a molecule depends on its environment. Enlist different factors that affect fluorescence of a molecule and explain *any one* of them.
- (b) What is meant by the quenching of fluorescence? How does it affect the quantum yield of a fluorescence emission?
- (c) What is meant by photoemission? Explain how does it depend on the structure of the molecule? **3x5=15**
4. (a) The determination of blood glucose is an important diagnostic procedure. Explain the principle of fluorimetric determination of blood glucose.
- (b) Describe the structure of a premixed or laminar flow flame clearly indicating different regions.
- (c) Explain the principle of atomic fluorescence spectroscopy with the help of a schematic energy level diagram. **3x5=15**

5. (a) The presence of phosphate in a sample containing calcium interferes with its atomic spectrophotometer determination. How can this interference be eliminated ? $3 \times 5 = 15$
- (b) Outline the major advantages of flame photometry.
- (c) Differentiate between resonance fluorescence and direct line fluorescence. What is the advantage of direct line fluorescence over resonance fluorescence ?
6. (a) Inductively coupled plasma are suitable for atomic emission spectroscopy but are rarely used for atomic absorption spectrometry. Explain.
- (b) What are electro thermal atomizers ? Describe the working of a graphite furnace.
- (c) Explain the principle of hydriale generation technique for the introduction of sample in AAS. $3 \times 5 = 15$
7. (a) Define chemical shift. List different factors affecting chemical shift of a porton in a molecule. 5
- (b) Write short notes on *any two* of the following : $2 \times 5 = 10$
- (i) Spin - spin splitting
- (ii) Double focussing analyser
- (iii) Mc Lafferty rearrangement

8. (a) Mass spectrometer employs different types of ion sources. Explain the principle of chemical ionisation method used as ion source in mass spectrometer. 5
- (b) The important spectral details of an organic molecule having a molecular formula C_7H_6O are as follows 10
- Mass* : Prominent peaks of $m/z = 51, 77$
(base peak) 105 and 106 (molecular ion)
- IR* : a medium Intensity doublet around 2800cm^{-1} ; 1720cm^{-1} (strong); 1600cm^{-1} and signals below 750cm^{-1} .
- NMR* : $\delta = 7.3\text{ppm}$ (5H, multiple), $\delta = 9.3$ (1H, singlet). Determine the structure of the molecule and assign the signals.
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