

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

Term-End Examination

June, 2013

MCH-003 : SPECTROSCOPIC METHODS

Time : 3 hours

Maximum Marks : 75

Note : Answer any five questions. All questions carry equal marks.

1. Answer *any five* of the following : 3x5=15
- (a) The pattern obtained in Young's double slit experiment consists of a series of dark and light bands. Explain the origin of these fringes.
 - (b) The absorption spectrum of a molecule in solution consists of broad bands. How would you explain the origin of such bands ?
 - (c) Enlist different types of species that may absorb in the UV - visible region of the spectrum. Explain the nature of transitions involved in any one of them.
 - (d) State necessary conditions for a molecule to show :
 - (i) UV absorption
 - (ii) IR spectrum

- (e) Differentiate between a flame atom cell and a non flame atom cell.
- (f) What is meant by isotopic peaks in mass spectrum ? What is their importance ?
2. (a) State Beer's law and enumerate the factors that may cause deviations from it. **5x3=15**
- (b) Monochromators are used to obtain monochromatic radiation from the output of a polychromatic source. Explain the principle of grating monochromator.
- (c) Outline the steps involved in quantitative determinations using UV-vis spectrometry. Explain the need for locating the wavelength of the maxima, λ_{max} .
3. (a) The transmittance of a 0.01M solution of a substance taken in a 0.1cm cuvette is found to be 8.50% .Determine the absorbance and the molar absorptivity. **5x3=15**
- (b) Draw a neat and labelled Jablonski diagram, clearly indicating the excitation and relaxation processes.
- (c) What is chemiluminescence? Explain with the help of an example .
4. (a) Determination of blood glucose level is an important diagnostic tool. Explain the principle of such a determination based on fluorescence measurements. **5x3=15**

- (b) In flame photometry, the analyte undergoes a number of processes when placed in the flame. Draw a schematic diagram illustrating these processes.
- (c) Different types of transitions are associated with atomic fluorescence spectrum. List these and explain any one of them.
5. (a) Hydride ion generation is commonly employed as a method for sample preparation in atomic absorption spectroscopy. Explain its principle. $5 \times 3 = 15$
- (b) What are line radiation sources? Why is it advantageous to use line sources in AAS?
- (c) Atomic spectroscopy is accompanied by a number of spectral interferences. State different types of spectral interferences observed in flame photometry.
6. (a) What is wear metal analysis? What is its importance? $5 \times 3 = 15$
- (b) Explain the principle of polychromator used in ICP-AES. How is it better than a sequential atomic emission spectrometer?
- (c) Compare the characteristics of AAS and ICP-AES.
7. (a) What makes tetramethyl silane (TMS) a molecule of choice for internal reference in PMR? 5

- (b) Write short notes on **any two** of the following : 5x2=10
- (i) Mc lafferty rearrangement
 - (ii) Spin -spin coupling
 - (iii) Factors affecting chemical shift
8. (a) Mass spectrometry is different from other spectroscopic methods. Explain the principle of mass spectroscopy. How is it different ? 5
- (b) The important spectral details of an organic compound having the molecular formula, C_7H_8 are given below : 10
- Mass : [M/z = 92 (molecular ion peak)
M/z = 91 (base peak)
- IR : 3050 cm^{-1} , 2905 cm^{-1} , 1605 cm^{-1} , 690 cm^{-1} and 750 cm^{-1})
- NMR : $\delta = 2.2$ (3H, S), $\delta = 7.2$ (5H, S)
- Determine the structure of the compound on the basis of the spectra and assign the signals.
-