



**RE-3565-66**

**M. Sc. (Part - II) Examination**  
**April / May - 2010**  
**Analytical Chemistry : Paper - I**  
*(Instrumental Methods of Analysis)*

Time : 3 Hours]

[Total Marks : 70

**Instructions :**

(1)

नीचे दृष्टावेक निशानीवाणी विगतो उत्तरवही पर अवश्य लपवी. Fillup strictly the details of signs on your answer book.	Seat No. :
Name of the Examination :	<input type="text"/>
<input type="text" value="M. SC. - 2"/>	<input type="text"/>
Name of the Subject :	<input type="text"/>
<input type="text" value="ANALYTICAL CHEMISTRY - 1"/>	<input type="text"/>
Subject Code No. : <input type="text" value="3"/> <input type="text" value="5"/> <input type="text" value="6"/> <input type="text" value="5"/>	<input type="text" value="Student's Signature"/>
Section No. (1, 2,.....) : <input type="text" value="NIL"/>	

- (2) All questions are compulsory.  
(3) Figures to right indicate full marks to that question.  
(4) Answers to all questions to be written in same answer book.

- 1 (a) Explain the principle of Diffused Reflectance IR Fourier Transform spectroscopy. How does it differ from absorption IR methods? 11
- (b) Define depolarization ratio in Raman spectroscopy. How do you measure it? On what factors does it depend?

**OR**

- (a) What is beam-splitter? Explain its function in FTIR instrument. Describe different materials from which it can be prepared.
- (b) Discuss the principle of Resonance Raman Spectroscopy. Name the sources used and mention advantages of this technique.
- (c) An organic compound having molecular formula  $C_7H_8O$ , exhibits the following significant IR bands in  $cm^{-1}$ . 3380, 3040, 2940, 1471, 1453, 1208, 1017, 740 and 690. Suggest the most probable structure with suitable justifications to each band.

- 2 (a) Describe second-order spectra in NMR. What are local diamagnetic effects in NMR? 11
- (b) Explain the principle of ESR spectroscopy. Define hyperfine coupling ( $A_o$ ) and g-value of ESR with suitable example.

OR

- (a) Explain the importance of Boltzmann excess in NMR. Discuss spin-spin relaxation in NMR. What are wide-line spectra?
- (b) Describe superhyperfine splitting in ESR spectrum of complex. What information it gives? Give one analytical application of ESR spectroscopy.
- (c) Assign the most probable structure to the organic compound consistent with the given NMR data :  
Molecular formula  $C_8H_{14}O_4$   
 $\delta = 1.2$ (t) 6H,  $\delta = 4.2$  (q) 4H,  $\delta = 2.6$  (s) 4H.

- 3 (a) Describe the principle and working of Time of Flight mass spectrometer. 11
- (b) Explain chemical ionization in mass spectrometry. What are the advantages and disadvantages? Explain the significance of M+1 peak.
- (c) Describe fragmentation pattern in butyraldehyde, with its major mass ions peaks in mass spectra.

OR

- (a) What are desorption ion sources for mass spectrometry? Describe Electrospray ionization method.
- (b) What are advantages of hyphenated mass spectrometry? Describe GC-MS linkage with function of jet separator.
- (c) Describe fragmentation pattern in ethylbenzene with its major mass ion peaks in mass spectra.

- 4 (a) Explain the principle of x-ray absorption. Define mass absorption coefficient and absorption edge. 12
- (b) Describe the principle of x-ray fluorescence spectroscopy. Discuss matrix effects in quantitative analysis of x-ray fluorescence.

OR

- (a) Differentiate between wavelength dispersive and energy dispersive x-ray spectrometers.
- (b) What are KLL and LMM Auger transitions? Describe sampling methods in surface and x-ray methods.
- (c) Aluminium is to be used as window for a cell for x-ray absorption measurements with  $\text{AgK}_{\alpha}$  line. The mass absorption coefficient for aluminium at this wavelength is  $2.74 \text{ cm}^2/\text{g}$ . Its density is  $2.70 \text{ g/cm}^3$ . What maximum thickness of aluminium foil could be used to fabricate the window if no more than 2.0% of radiation is to be absorbed by the window?
- 5 (a) Explain the working of graphite furnace atomizer in AAS. Give its advantages. 16
- (b) Explain working of direct current plasma source of emission spectroscopy. Compare it with dc arc source.
- (c) Discuss the functions of spectrochemical buffer and stallwood jet in emission spectroscopy. Give characteristics and type of samples studied in arc and spark sources.

OR

- (a) Describe premix burner used for atomization. Give its advantages and disadvantages.
- (b) What is plasma? How it is produced in ICP? Describe different temperature zones of ICP discharge.
- (c) Explain the interferences due to atomic line overlap and physical properties of the solution in AAS. How it can be avoided?
- (d) A 500 mg sample containing Cd is digested in acid and diluted to 50.0 ml. A 10.0 ml aliquot is further diluted to 25.0 ml and analysed for Cadmium using AAS. The absorbance reading is 0.190. To 10.0 ml of other aliquot, is added 1.0 ml 0.5 ppm standard cadmium solution, and diluted to 25.0 ml. The absorbance now reads 0.230. Calculate cadmium content in the given sample in ppm units.

- 6** (a) Explain bipolar junction transistors. **9**
- (b) Name any three different logic gates with their symbol, truth table and Boolean expressions.

**OR**

- (a) Explain non electrical and electrical data domains.
- (b) What is the use of filters based on RC circuits? Describe high pass and low pass filters.
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