B. Tech.
(SEM. VI) EXAMINATION, 2006-07
INSTRUMENTAL & ANALYTICAL CHEMISTRY

Time : 2 Hours] [Total Marks : 50

Note :  (1) Attempt all questions.
(2) In case of numerical problems assume data wherever not provided.
(3) Be precise in your answer.

1  Attempt any four parts of the following :  3×4=12

(a) What is an auxochrome? Explain how an auxochrome exerts a bathochromic shift on a chromophore such as an ethylenic bond?

(b) What is the basic principle for a spectrophotometric titration? What are the advantages of such a titration?

(c) Why the \( \lambda_{\text{max}} \) for the diene A is observed at lower nm than B? Explain.

\[ \text{Diagram: } \begin{array}{c}
\text{A} \\
\text{B}
\end{array} \]

V-9934]  1  [Contd...
(d) What are metastable ions? Explain their utility in confirming a proposed mass fragmentation pattern.

(e) Why are molecular ion peaks either very weak or completely absent from the mass spectrum of many compounds? Explain how this limitation can be overcome.

(f) Explain how spectrophotometry is used in the study of the formation of complexes?

2 Attempt any four parts of the following: 3.5x4=14

(a) Discuss the basic principle of Nuclear Magnetic Resonance spectroscopy.

(b) Giving examples explain equivalent and non-equivalent protons. What is their significance in NMR spectroscopy?

(c) A compound having the molecular formula C₉H₁₁ Br gave the following ¹H NMR data:

\[ \delta \quad \text{2.15 (2H, quintet),} \quad \delta \quad \text{2.75 (2H, triplet),} \quad \delta \quad \text{3.38 (2H, triplet),} \quad \delta \quad \text{7.22 (5H singlet)} \]

Assign the structure to the compound.

(d) ¹³C is NMR active while ¹²C is not, explain.

(e) Explain shielding and deshielding of a nucleus in NMR spectroscopy.

(f) What is Relaxation process in ¹H NMR spectroscopy? Explain its significance.

[V-9934] 2 [Contd...]
3 Attempt any two parts of the following: 6x2=12
(a) Giving a schematic sketch discuss the working of the IR spectrometer.
(b) Write short notes on:
   (i) Raman spectroscopy
   (ii) Molecular vibrations
   (iii) Fundamental vibrations and overtones
(c) How would you distinguish between the compounds in each pair by IR spectral studies.
   (i) Phenol and cyclohexanol
   (ii) cis and trans 2-Butane
   (iii) Acetaldehyde and acetone

4 Attempt any two parts of the following: 6x2=12
(a) What are the basic components of the gas chromatograph? Describe each in brief.
(b) Explain the principle of conductometric titrations and various titration curves obtained in acid-base titrations.
(c) (i) Describe the basic principle underlying chromatographic process.
    (ii) Explain the terms - half-wave potential, limiting current, DME.