



**M.Sc. II Semester Degree Examination, Sept./Oct. - 2024**

**CHEMISTRY**

**Spectroscopic and Thermal Methods**

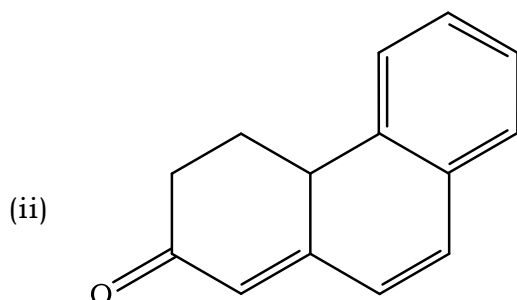
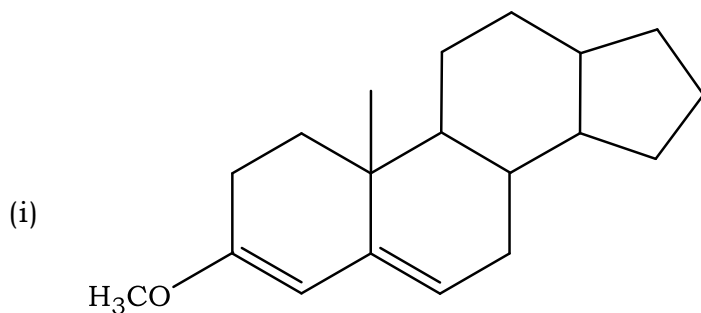
**(NEP)**

Time : 3 Hours

Maximum Marks : 70

**Note :** Answer **any five** of the following questions with Question No. **1 Compulsory**, each question carries **equal** marks.

1. (a) Discuss the role of the Great Orthogonality Theorem in group theory and Symmetry. **5+5+4=14**  
 (b) Enumerate how group theory can be applied to determine the vibrational modes, hybridization, and molecular orbitals of molecules.  
 (c) Construct the character table for  $C_{3V}$  point group.
2. (a) What factors contribute to the broadening of spectral lines ? Explain the interaction between electromagnetic radiation with matter. **5+5+4=14**  
 (b) What are electromagnetic radiations ? Explain their properties.  
 (c) How do vibration-rotation fine structures provide information about molecular energy levels ? Discuss.
3. (a) Discuss the chromophore-auxochrome theory in UV-Visible Spectroscopy.  
 (b) Enumerate the factors that must be considered when selecting a solvent for spectroscopic analysis. **5+5+4=14**  
 (c) Predict  $\lambda$ -max for following compound using Woodward-Fieser Rules.



4. (a) Illustrate the principle and applications of ICP. **5+5+4=14**  
(b) Discuss the key components of instrumentation in flame photometry. What is the function of the burner, and how does it affect the measurement process ?  
(c) Discuss the differences in instrumental design between atomic absorption spectrometry and flame photometry.
5. (a) What is a thermogram ? Explain the factors that affect the results of thermogravimetric analysis. **5+5+4=14**  
(b) Discuss the applications of DTA in the study of thermal behavior of substances.  
(c) Explain the concept of simultaneous DTA-TGA analysis. How do the combined curves provide a more comprehensive understanding of thermal events ?
6. (a) Explain the significance of selection rules in determining the allowed transitions and discuss how these principles applied to the interpretation of complex spectra. **5+5+4=14**  
(b) Discuss the steps involved in determining the concentration of a substance from its absorption spectrum, including calibration and data interpretation.  
(c) Compare and contrast single beam and double beam spectrophotometers used in UV-Visible spectroscopy. What are the advantages and disadvantages of each type ?
7. (a) Describe the limitations and interferences encountered in Atomic Emission Spectrometry. **5+5+4=14**  
(b) Explain the effect of concentration, particle size, and wavelength on scattering in nephelometry.  
(c) Discuss the importance of baseline correction and sample preparation in achieving accurate results in Differential Scanning Calorimetry.
8. (a) Explain the properties of the solvent used in UV-Visible spectroscopy. **5+5+4=14**  
(b) Account on the procedure used for the measurement of colour by UV-Visible spectroscopy. Discuss its application in analyzing  $\text{NH}_3$ .  
(c) What are non-flame techniques and how do they differ from traditional flame methods ? Explain when non-flame techniques are preferred with their advantages.

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