



I Semester M.Sc. Degree Examination, May 2014
CHEMISTRY
Chemical Spectroscopy

Time : 3 Hours

Max. Marks : 80

Instruction : Answer question no. 1 and **any four** full questions from the remaining.

1. Answer **any eight** questions. (8×2=16)
- a) What is the dual nature of electron ?
 - b) Which of the following compounds will not exhibit ESR spectroscopy ?
 - i) NO,
 - ii) CO₂.
 - c) How can symmetric and asymmetric top molecules be distinguished ?
 - d) What are chromophores ? Give one example.
 - e) Explain the effect of increasing solvent polarity on $n - \pi^*$ transition.
 - f) What are hot bands ?
 - g) How conjugation affect the group frequency ? Explain with example.
 - h) Which of the following atoms does not exhibit NMR ? ¹²C, ¹⁵N, ¹³C. Explain why ?
 - i) What is coupling constant ?
 - j) Outline the differences between NMR and NQR.
2. a) Explain the basic principles of ESR spectroscopy.
b) What are the different regions associated with electromagnetic radiations ? Indicate the corresponding spectral techniques.
c) Write a note on hyperfine splitting and spin-orbit interactions. (4+6+6=16)
3. a) What types of molecules gives rotational spectra ? Which of the following molecules gives rotational spectra ? H₂, HCl, CH₃Cl, Cl₂.
b) Obtain the expression for the moment of inertia of rigid diatomic rotator.
c) Discuss Frank-Condon principle. (4+6+6=16)

MCHT 1.4



4. a) What are overtone bands ? obtain the expression for fundamental and first overtone bands.
- b) Derive the equation for vibrational energy of simple harmonic oscillator.
- c) Force constant for H¹⁹F molecule is 966 N/m. Find the frequency of vibration of the molecule. **(6+6+4=16)**
5. a) What is meant by chemical shift in NMR ?
- b) Write a note on Geminal proton-proton coupling and Vivinal proton-proton coupling.
- c) What is Mc Lafferty rearrangement ? Illustrate with example. **(5+5+6=16)**
6. a) What is g-factor ? Describe the width and position of spectral lines in ESR spectra.
- b) Explain briefly the factors determine the intensities of rotational lines for linear molecules.
- c) Write a note on Bathochromic and Hypsochromic shifts. **(5+5+6=16)**
7. a) Discuss the effect of ring strain and hydrogen bonding on IR spectra.
- b) Describe the quantum theory of Raman spectra.
- c) With example describe various factors affecting the magnitude of chemical shift. **(5+5+6=16)**
-