

**FACULTY OF SCIENCE****M.Sc. IV-Semester Examination, May / June 2018****Subject : PHYSICS****Paper - II  
Spectroscopy****Time : 3 hours****Max. Marks : 80**

**Note : Answer all questions from Part-A and Part-B. Each question carries 4 marks in Part-A and 12 marks in Part-B.**

**PART – A (8 x 4 = 32 Marks)**  
(Short Answer Type)

- 1 What are different series in alkali spectra?
- 2 What are intensity rules in atomic spectra?
- 3 Discuss the isotopic effect on rotational spectra.
- 4 Explain the vibrational energy levels of an anharmonic oscillator.
- 5 Discuss the classical theory of Raman effect.
- 6 Explain normal vibrations of CO<sub>2</sub> and H<sub>2</sub>O molecules.
- 7 What is chemical shift?
- 8 Discuss the basic principle of ESR.

**PART – B (4 x 12 = 48 Marks)**  
(Essay Answer Type)

- 9 a) What is spin-orbit interaction? Discuss doublet structure in alkali spectra.  
**OR**  
b) Explain in detail L-S and j-j coupling schemes and discuss energy levels and spectral transitions in Helium.
- 10 a) What are the salient features of rotational spectra? Obtain the expression for the rotational energy of a rigid rotator and discuss its rotational spectrum.  
**OR**  
b) Obtain an expression for the energy of harmonic oscillator and discuss its vibrational – rotational spectra.
- 11 a) Discuss the energy levels and transitions in vibrational Raman spectra of a diatomic molecule.  
**OR**  
b) How do you interpret the data from Raman and IR spectroscopy? Describe the working principle of FTIR spectrophotometer.
- 12 a) Obtain resonance condition in NMR spectroscopy and derive Bloch equations.  
**OR**  
b) What is total Hamiltonian of a system? Describe the principle and design of ESR spectrometer.