

M.Sc.(Physics) (CBCS Pattern) Semester-III
PSCPHYT12-1 - Paper-XII (Foundation Course F 1.1) - Fundamentals of Spectroscopy

P. Pages : 2

Time : Three Hours



GUG/W/24/11304

Max. Marks : 80

Either:

1. a) Derive an expression for Lande's splitting factor (g) and explain anomalous Zeeman effect. 8
- b) With the help of Schrodinger wave equation discuss the atomic energy levels of hydrogen atom. 8

OR

- e) Explain how atomic states are represented by L-S and $j - J$ coupling schemes using vector diagrams. 8
- f) Describe stern-Gerlach experiment. Show how it verifies the principle features of vector atom model. 8

Either:

2. a) Explain rotational spectra of rigid-diatomic molecules. 8
- b) Discuss the salient features of vibrational rotational spectra. 4
- c) Outline the effect of isotopic substitution on the rotational spectra of molecules. 4

OR

- e) Describe Born-Oppenheimer approximation. 8
- f) Explain the vibrating diatomic molecule as anharmonic oscillator. 8

Either:

3. a) Discuss the pure rotational Raman spectra. 8
- b) Discuss the main features of vibrational and rotational Raman spectra of diatomic molecule. 8

OR

- e) Discuss how Raman spectroscopy is used for structure determination of diatomic molecules. 8
- f) How are Raman spectra studied in the laboratory. 8

Either:

4. a) State and explain Frank-Condon principle. 8
- b) Discuss the formation of PQR branches. The band head of the Q-branch is always at $J = -\frac{1}{2}$ while that of P or R-branch may be anywhere, explain. 8

OR

- e) Explain the phenomena of fluorescence and phosphorescence. 8
- f) Discuss Fortrat parabola. 8
5. Attempt all of the followings.
- a) Explain stark effect in one electron system. 4
- b) What are the advantages of using FTIR spectrophotometer over conventional IR spectrophotometer. 4
- c) How is Raman spectra is different from fluorescence spectrum. 4
- d) What is pre-dissociation energy. 4
