DS-547

Roll No. ....
500 -/-/15/20

January 2018
M. Sc. IIIrd Semester Examination

PHYSICS
Fourth Paper : Atomic and Molecular Physics

Time 3 Hours]

[Max. Marks : Regular 85 / Private 100
[Min. Marks : Regular 28 / Private 33

Note : This question paper is meant for all **Regular** and **Private** students. Answer all five questions. All questions carry equal marks. The blind candidates will be given 60 minutes extra time.

1. Discuss relaxation processes. Explain Larmor precession and Larmor frequency. What is NMR imaging ?

OR

Write down the rules for determining net spin of a nucleous. Explain the splitting of energy levels and calculate the transition energy.

2. (a) Explain the formation of electronic spectra.
   (b) The origine of the $(v' = 0) \to (v'' = 6)$ bond in an electronic transition is located at 35600 cm^{-1}. Given that $w_e = 1460 \text{ cm}^{-1}$ and $w_e'' = 2360 \text{ cm}^{-1}$ for the above transition, based on the assumption that harmonic approximation is adequate. Calculate v_e.

OR

State and explain Frank-Condon principle. How does it account for the intensities of lines in vibrational electronic spectra.

3. Define Raman effect and write its explanation by quantum theory. Discuss molecular polarizability in Raman effect.

OR

Illustrate with example of CO_2, N_2O, SO_2, NO_3, ClO_3 and ClF_3 to determine the shape of molecules from Raman and infrared spectroscopy.

4. What is Mossbauer effect ? High lights the special features of Mossbauer spectroscopy. How is it superior over / ray spectroscopy techniques.

OR

   (a) Explain the quadraupole effects and the effect of a magnetic field in Mossbauer spectroscopy.
   (b) Explain Mossbauer spectrometer with a block diagram.

5. Explain the principle of ESR. Why microwave source and techniques have to be applied for the observation of ESR.

OR

What do you mean by g factor ? derive expression for g. Discuss the role of g in ESR.

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