DS-547

Roll No. .....
800 -/-/25/30

February 2019

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. (a) Calculate the NMR frequency of F^{19} nucleus when it is placed in the magnetic field of 1.0 T. Given that $g_I = 5.256$ and $\mu_N = 5.0504 \times 10^{24}$ J/T. Also calculate the relative population in two spin states.
   (b) Why are the nuclei of some elements magnetic ?

   OR

   Explain the following terms :
   (a) Shielding Constant
   (b) Anisotropy of Chemical Bone
   (c) Larmor Frequency
   (d) Coupling Constant
   (e) TMS
   (f) Detection of Relaxation Process.

2. Describe how electronic excitation leads to dissociation and pre dissociation ? Describe dissociation energy and dissociation products in reference to dissociation and pre dissociation.

   OR

   Describe the general character of electronic spectra of diatomic molecule and explain vibrational coarse structure and rotational fine structure in absorption and emission process.

3. State the main application of Raman Effect. discuss structural determination from activities of planar AB_2 molecule and pyramidal AB_3 molecules.

   OR

   What is polarizability ellipsoid ? Explain it for symmetric top, linear and spherical top molecules.

4. What is Mossbauer effect ? Highlight the special features of Mossbauer spectroscopy. How is it superior over ray spectroscopic techniques ?

   OR

   Outline three applications of Mossbauer spectroscopy.

5. Explain any four :
   (a) What is g value standard ?
   (b) How triplet state atoms are investigated in ESR ?
   (c) What are the advantages of recording ESR signal in derivative form ?
   (d) What is a low g or high g indicates ?
   (e) What is Zero field splitting ?
   (f) What are the number of peaks for a large assembly of randomly oriented spins ?
   (g) How high magnetic field and no electric field at the centre of cavity in ESR spectrometer is established ?
   (h) Why Wave guides are used in ESR and no focussing devices for Microwave propagation ?