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DEPARTMENT OF SCIENCES

3rd semester M Sc Physics-end sem examination

PHY 701- Atomic and Molecular Physics

Time : 3 Hours - - 2015 Max Marks : 50

Answer any **FIVE** of the following questions.

1. a) Explain quantization of angular momentum. Show that it is in accordance with uncertainty principle.

   b) The Zeeman components of a 500 nm spectral line are 0.0116 nm apart when the magnetic field is 1.00 T . Find the ratio e/m for the electron. **(6 + 4) marks**

2. a) Write a note on spin-orbit coupling. Why is the ground state of hydrogen atom not split into two sublevels because of this effect.

   b) What are the possible values of **L** for a system of two electrons whose orbital quantum numbers are $l_1 = 1$ and $l_2 = 3$. Also find the possible values of **S** and **J.** Draw a schematic diagram for any L and S coupling in the presence of a magnetic fi **(5+ 5) marks**

3. a) Illustrate the method of determining the two bond lengths in carbon oxysulfide (OCS).

   b) Discuss the spectra of an an-harmonic oscillator. **(5+ 5) marks**

4. a) Explain the necessary and sufficient condition for a molecule to be vibrationally Raman active. State the rule of mutual exclusion. **10 marks**

5. a) What is nuclear spin relaxation? How the relaxation time is defined? Explain the relaxation processes.

   b) Explain chemical shift in NMR spectra. **(5+ 5) marks**

6. a) Write a note on X-ray photoelectron spectra of gases.

   b) Explain KL_IL_{II} Auger process. **(5+ 5) marks**

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