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Prepared by
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DEPARTMENT OF SCIENCES

3rd semester M Sc Physics-end sem examination(Make up)

PHY 701- Atomic and Molecular Physics

Time: 3 Hours | 26 - 12 - 2016 | Max Marks : 50

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

1. a) Explain Zeeman effect with necessary theory.

   b) The spin-orbit effect splits the $3P \rightarrow 3S$ transition in sodium into two lines, 589.0 nm corresponding to $3P_{3/2} \rightarrow 3S_{1/2}$ and 589.6 nm corresponding to $3P_{1/2} \rightarrow 3S_{1/2}$. Use the data to calculate the effective magnetic field experienced by the outer electron of the sodium. Given: Bohr magneton = 9.27×10^{-24} J/T. **(6 +4) marks**

2. a) 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 field. **(5+ 5) marks**

   b) Writ a note on selection rules for electronic transition. A hydrogen atom is in the 4p state. To what state or states can it go by radiating a photon in an allowed transition? **(6+4) marks**

3. a) Discus the rotational spectra of diatomic molecules.

   b) Discuss the harmonic vibrational spectra of a linear molecule. **(5 +5) marks**

4. a) What is Raman scattering? Give the Quantum mechanical explanation of the effect.

   b) Discuss vibrational Raman spectra of linear molecules. **(5 +5) marks**

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

   b) Explain multiple pulse FT in determining the spin lattice relaxation. **(5 +5) marks**

6. a) Explain X-ray photoelectron spectra of gases with an example.

   b) Explain the processes involved in X-ray fluorescence and Auger effect. **(5 +5) marks**

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