

(3 Hours)**(Total 75 marks)****NB:** Attempt all six questions.

Answers of both sections must be written in same answer book.

1. a) Describe the periodic system of elements in detail. 12
 b) Discuss Lamb shift experiment in detail.
- OR
2. Discuss the correction for fine structure of hydrogen atom in detail 12
3. Discuss the selection rule for radioactive transition in an atom considering transition in which single photon is emitted or absorbed. 13
- OR
4. How does electromagnetic field interacts with an atom? Starting from scalar and vector potential, derive the equation for the intensity of the radiation. Calculate the intensity of a laser of 1mW power with monochromatic emission of 638nm and beam diameter of 5mm. Also find number of photons emitted per second. 13
5. Describe Hydrogen Molecular ion with the help of Molecular Orbital theory. 13
- OR
6. a) Compare the MO and VB theories.
 b) Discuss the working of ESR spectrometer. 13

Section2

7. a) Write a short note on :a) Threshold conditions b) Absorption of radiation.
 b) Assume that an atom has two energy levels separated by energy corresponding to the frequency 5×10^{14} Hz. All the atoms are located in one or other of these two states. Calculate the fraction of atoms in the upper state at temperature $T=5500\text{K}$. 12
- OR
8. Explain in detail 12
 1) Homogeneous broadening. 2) inhomogeneous broadening.
9. a) What is Plasma? State and derive any two important conditions for occurrence of plasma.
 b) What is Debye radius? Find Debye radius for a glow discharge with $n= 10^{16}/\text{m}^3$ and energy of 1.5eV. 13
- OR
10. a) Discuss concept of ambipolar diffusion and show that the effect of ambipolar electric field is to enhance the diffusion of ions by factor of two. 07

- b) What is Larmor radius? Find Larmor radius of a 5KeV electron in the magnetic field of 1T. 06
11. p) How is Holography different than photography? 12
- q) What are the key factors involved in designing the laser? 12
- OR
12. Write short note on any THREE 12
- a. Plasma Etching
 - b. Glow discharge.
 - c. Magnetic probes
 - d. ion acoustic waves
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