[Total No. of (i) Printed Pages 4 (ii) Questions 7]

Sub Code : 0349 (1048) **Exam Code :** 0004

Exam : B.A./B.Sc.(General), 4th Semester

Subject : Physics

Paper : Paper : C Quantum Physics-II

Time : 3 Hours ***Maximum Marks : 22***

Note: (i) Attempt **five** questions in all selecting **two** questions from each of **Section-A** and **B. Section- C** is compulsory.

(ii) Use of non-programmable calculater **or** log table is allowed.

SECTION - A

1. (a) Derive an expression for transition probability of spontaneous emission of radiation. 3

(b) Show that average lifetime of an atom in the excited state is inversely proportional to the transition probability. 1

2. (a) Describe Franck-Hertz experiment for the verification of the presence of discrete energy states in atoms. 3

P.T.O.

(b) Find the magnitude of spin-orbit energy for state $^2P_{3/2}$ of hydrogen atom. The radius of orbit is $4a_0$. 1

3. (a) What is stark effect ? Explain this effect in hydrogen atom in weak and strong magnetic field. 3

(b) The yellow light of sodium light arising from 3P to 3S transition in sodium. Write the terms corresponding to allowed transition. 1

SECTION - B

4. (a) Discuss the spectra of mercury atom, draw the possible transitions and write the selection rules for these transitions. 3

(b) What are identical particles ? Why it is difficult to distinguish them in quantum mechanics. 1

5. (a) Explain the production of characteristic and continuous X-ray spectra. State the important properties of X-rays. 3

(b) Calculate the maximum frequency of the continuous X-rays emitted from X-ray tube whose operating voltage is 40,000 volts. 1

6. (a) Define and explain Raman effect and show that frequency difference in Raman lines is twice the frequency difference between successive lines in a pure rotational spectrum of the molecule. 3

(b) Explain experiment set up and theory of magnetic resonance experiments. 1

SECTION - C

7. Attempt any **six** parts : 1×6=6

(i) What is fine structure ? What is its cause ?

(ii) Find the possible values of m_j for states in which l=2 and s=1/2.

(iii) Differentiate between symmetric and antisymmetric wave functions.

(iv) Why tungsten widely used as target material in X-ray tube ?

(v) What is Auger effect ?

(vi) What are molecular orbitals ? How do they differ from atomic orbitals ?

(vii) What is the rotational energy of diatomic molecule in its ground state ?

(viii) What is the value of spin magnetic moment of free electron ?

(ix) Why normal Zeeman effect occurs only in atoms with even number of electrons ?

(x) How are characteristic X-rays used to identify elements ?