(i) Printed Pages: 3

(ii) Questions : 7

Roll No. .....

Sub. Code : 0349

Exam. Code : 0004

B.A./B.Sc. (General) 4th Semester

(2042)

PHYSICS

(Quantum Physics–II)

Paper–C

Time Allowed : Three Hours] [Maximum Marks : 44

Note :— (1) Attempt **five** questions in all, selecting **two** questions each from Unit I and Unit II. Unit III is compulsory.

(2) Use of non-programmable calculator is allowed.

UNIT–I

1. (a) Derive a relation between transition probability and average life time of an atom in excited state. 6

(b) What is the Rydberg constant ? Its value is same for all nuclei or not ? 3

2. (a) What is anomalous Zeeman effect ? Derive an expression for splitting of levels in an anomalous Zeeman effect. 6

(b) Find the possible orientation of $\vec{J}$ for $j = 3/2$ with respect to a magnetic field along Z-axis. 3

3. (a) Derive an expression for total magnetic moment of an electron in an atom due to the interaction of its orbital and spin angular momenta. 6

(b) What magnetic flux density B is required to observe the normal Zeeman effect if a spectrometer can resolve spectral lines separated by 0.2Å at 2000Å. 3

UNIT–II

4. (a) Discuss and draw the spectra of alkali atoms qualitatively. Give the various selection rules used. 6

(b) Consider an atom with an electronic configuration $1s^2 2s^2 2p^1$. Find the magnitude of total angular momentum. 3

5. (a) Discuss the construction and working of Coolidge tube. How can you control (i) quality and (i) quantity of X-rays in Coolidge tube ? 6

(b) Calculate the frequency of K_α line when atomic number of the anticathode is 79. Given $R = 1.097 \times 10^7 m^{-1}$. 3

6. (a) Discuss the vibrational-rotational spectra of diatomic molecules and also write its selection rules. 6

(b) Explain experimental set up and theory of magnetic resonance experiments. 3

UNIT–III

7. Attempt any **eight** parts :

(a) Which orbit corresponds to maximum energy state in Bohr model of atom ?

(b) Write the possible values of total magnetic quantum number mj for 1 = 2.

(c) How many electrons would be there if all electronic shells through n = 5 is completely occupied ?

(d) What do you mean by parahelium and orthohelium ?

(e) Auger effect is an internal photoelectric effect. Comment.

(f) Can the Stern-Garlach experiment be performed with ions rather than neutral atoms ?

(g) In rotational spectra, energy levels and frequency are equally spaced or not ?

(h) Explain if high speed electrons are made to fall on hydrogen atom, will X-rays be emitted ?

(i) What is Stark effect ?

(j) Why do molecules show band rather than line spectra ?

$1 \times 8 = 8$