

(i) Printed Pages: 3

Roll No. ....

(ii) Questions : 7

Sub. Code :

0	3	4	9
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Exam. Code :

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B.A./B.Sc. (General) 4<sup>th</sup> Semester  
(2054)

PHYSICS

Paper-C : Quantum Physics-II

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. From Q. No. 7 attempt any EIGHT parts.

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

### UNIT—I

- (a) Discuss quantum mechanical theory of anomalous Zeeman Effect with reference to  $D_1$  and  $D_2$  lines of sodium. 6

(b) Find the value of spin-orbit interaction energy for the state  $2p_{3/2}$  of the electron in H-atom. Given the radius of this state =  $3a_0$ . 3
- (a) Give brief description of Stern Gerlach experiment. Explain its significance. 6

(b) What is Lande's g factor ? Give its importance. Calculate Lande's g factor for p-electrons. 3

3. Show that the transition probability of electric dipole is directly proportional to the energy density of radiation. For one electron atomic system interaction with radiation, what are the allowed transitions ? 9

### UNIT—II

4. (a) Describe the spectrum of helium atom and discuss the difference between para-helium and ortho-helium. 6  
(b) Considering an atom having electronic configuration  $1s^2 2s^2 2p^1$ . Find the magnitude of total angular momentum. 3
5. (a) What is Moseley's law of X-ray emission ? Derive it from Bohr's theory of atom. Give the importance of Moseley's law. 6  
(b) The  $K_\alpha$  line for molybdenum (atomic number 42) has a wavelength of  $0.078 \text{ \AA}$ . Calculate  $K_\alpha$  line for copper (atomic number 29). 3
6. (a) Give the theory of vibrational energy levels of diatomic molecules. How frequencies of different spectral lines result from them ? 6  
(b) What is Raman Effect ? What are its selection rules ? 3

### UNIT—III

7. Attempt any **EIGHT** parts :—  
(i) What is Auger effect ?  
(ii) What are molecular orbitals ?

- (iii) Why should anti-cathode of X-ray tube be of high atomic number ?
- (iv) What are symmetric and antisymmetric wave functions ?
- (v) State Franck Condon Principle.
- (vi) What is hyperfine structure ?
- (vii) What is Stark Effect ?
- (viii) Explain difference between fluorescence and phosphorescence.
- (ix) What are identical particles ?
- (x) Two bosons can exist in the same quantum state but two fermions cannot exist in the same quantum state. Explain why.

$$8 \times 1 = 8$$