(i) Printed Pages : 3 Roll No. .....

(ii) Questions : 7 Sub. Code : 0349

Exam. Code : 0004

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

(2053)

PHYSICS

Paper : C Quantum Physics–II

Time Allowed : Three Hours] [Maximum Marks : 44

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

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

UNIT—I

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

(b) What is the value of spin magnetic moment of a free electron in terms of Bohr magneton ? 3

2. (a) Discuss quantum mechanical theory of anomalous Zeeman effect with special reference to D1 and D2 lines of sodium. Draw clear diagram. 6

(b) Derive an expression for Land's g-factor. 3

3. (a) What is Paschen Back effect ? Explain this effect in weak and strong magnetic field. 6

(b) Find the orbital angular momentum for 3f electron. Also find magnitudes of its possible z-components. 3

UNIT—II

4. (a) Explain L-S coupling and write the spectral terms for atoms with two equivalent electrons. 6

(b) Is $^2D_{7/2}$ is possible term ? Why ? 3

5. (a) State and explain Mosley's law. Derive it from Bohr theory. Give its physical significance. 6

(b) What voltage must be applied to an X-ray tube for it to emit X-rays with minimum wavelength of 0.4Å ? 3

6. (a) Give theory of vibrational energy levels of diatomic molecule. How frequency of different spectral lines results from them ? 6

(b) Discuss the Franck-Condon principle in emission. Discuss its importance. 3

UNIT—III

7. Attempt any **eight** parts :

(i) What is continuum of energy states ?

(ii) What is Larmor precession ?

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

(iv) What is the root cause of the spectral lines of an atom ?

(v) What is Moseley's law ?

(vi) Why does symmetric orbital wave function leads to binding in the H_2 molecule ?

(vii) What are non-equivalent electrons ?

(viii) What is fine structure of Hydrogen atom ?

(ix) What do you mean by space quantization ?

(x) Can the Stern-Garlach experiment be performed with ions rather than neutral atoms ? $1 \times 8 = 8$