

(i) Printed Pages : 3

Roll No.

(ii) Questions : 7

Sub. Code :

| | | | |
|---|---|---|---|
| 0 | 2 | 4 | 9 |
|---|---|---|---|

Exam. Code :

| | | | |
|---|---|---|---|
| 0 | 0 | 0 | 3 |
|---|---|---|---|

B.A./B.Sc. (General) 3rd Semester

(2123)

PHYSICS

Paper-C (Quantum Physics-I)

Time Allowed : Three Hours]

[Maximum Marks : 44

Note :— (1) Attempt **five** questions in all, selecting **two** questions each from Unit-1 and Unit-2. Question No. 7 (Unit-3) is compulsory.

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

UNIT—1

1. (a) Discuss uncertainty principle. With the help of uncertainty principle prove the non-existence of electron with the nucleus. Why a beam of shorter wavelength gives accurately the position of a particle ? 6
- (b) Find the energy of photon whose de Broglie wavelength is 1 \AA . 3
2. (a) Give the significance of Compton effect. Show that the change in wavelength of photon scattered in Compton experiment is independent of wavelength of the incident radiation. 6

- (b) Monochromatic X-rays of wavelength 0.144 \AA are scattered by a carbon block. Find the wavelength of X-rays scattered through 120° . 3
3. (a) State Ehrenfest theorem and prove $\langle p_x \rangle = m \frac{d \langle x \rangle}{dt}$. 6
- (b) What is electron microscope? Also state the principle of electron microscope. 3

UNIT—2

4. (a) What is Harmonic oscillator? Obtain an expression for its energy by solving Schrodinger wave equation. What is zero point energy of Harmonic oscillator? 6
- (b) Calculate the expectation value for position for a particle confined to one dimensional infinite square well potential. 3
5. (a) Write down Schrodinger equation for an electron of hydrogen atom. Obtain the three independent differential equations for Schrodinger wave equation in spherical polar coordinates. 6
- (b) On what factor potential of Hydrogen atom depends? 3
6. (a) What is tunnelling through a barrier? Calculate the reflection coefficient of a particle through a one dimensional potential barrier for energy less than step height. 6
- (b) For principal quantum number 1, calculate energy of an electron in a dimensional box of length 1 \AA . 3

7. Attempt any **eight** parts :

- (a) What are the conditions for a wave function to be called well-behaved wave function ?
- (b) What is Hermitian operator ?
- (c) Define threshold frequency for photoelectric effect.
- (d) A proton and a deuteron having same energy penetrate a given rectangular barrier. Which particle has a greater depth of penetration ?
- (e) A photon of energy 1.02 MeV is scattered through 90° by a free electron. Calculate the energy of photon.
- (f) With what purpose was famous Davisson-Germer experiment with electrons performed ?
- (g) What is energy operator ?
- (h) How tunnel effects explain alpha decay ?
- (i) Show that operator P_x and P_y commute.
- (j) Prove that the linear momentum of a particle in infinite square well is quantized. $1 \times 8 = 8$