

(i) Printed Pages: 3

Roll No.

(ii) Questions : 7

Sub. Code :

0	2	4	9
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Exam. Code :

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

1128

PHYSICS

Paper—C : Quantum Physics—I

Time Allowed : Three Hours]

[Maximum Marks : 22

Note :— (1) Attempt **five** questions in all, selecting **two** from each Unit—I and Unit—II. Question no. 7 (Unit—III) is compulsory.

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

UNIT—I

1. (a) Explain De-broglie hypothesis. With the help of suitable diagram explain Davisson and Germer experiment in its support. 3
- (b) Calculate the wavelength associated with an electron subjected to potential difference of 1.25 kV. 1½
2. (a) Discuss Gaussian wave packet. Give its characteristics. 2½
- (b) Derive Uncertainty Principle using Gaussian Wave Packet. 2

3. (a) Prove that phase velocity is one half of the particle velocity, whereas group velocity is equal to the particle velocity. 3
- (b) What is the condition for orthogonal and normalized wave function ? 1½

UNIT—II

4. What is Harmonic oscillator ? Obtain an expression for its energy by solving Schrodinger wave equation. Discuss its importance. 4½
5. (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. 3
- (b) How tunnel effect explains alpha decay ? 1½
6. Write down Schrodinger equation for an electron of hydrogen atom. Obtain the three independent differential equations for Schrodinger wave equation in spherical polar coordinates. 4½

UNIT—III

7. Attempt any **eight** parts :
- (a) How does the K.E. of photoelectrons vary with intensity of light ?
- (b) An electron and proton have same wavelength. Which of them has more energy ?

- (c) Show that Px^2 is a Hermitian operator.
- (d) Calculate the commutator for position and momentum operator $[x, P_x]$.
- (e) What are the admissibility conditions on the wave function ?
- (f) What are the conjugate variables ?
- (g) Show that $ie^{i\phi}$ is an eigenfunction of Z component of angular momentum operator. Find the eigenvalue.
- (h) Prove that linear momentum of a particle in infinite square well is quantized.
- (i) Why Compton effect is not observed with visible light ?
- (j) How are spherical co-ordinates related to Cartesian coordinates ?

$$\frac{1}{2} \times 8 = 4$$