NA—22—2023

FACULTY OF SCIENCE

B.Sc. (Third Year) (Fifth Semester) EXAMINATION

NOVEMBER/DECEMBER, 2023

(CBCS/New Pattern)

PHYSICS

Paper-XII

(Quantum Mechanics)

(Thursday, 7-12-2023)   **Time : 10.00 a.m. to 12.00 noon**

Time—2 Hours   *Maximum Marks—40*

N.B. :— (i)   *All* questions are compulsory.

(ii)   All symbols have their own usual meanings.

(iii) Given :

(a)   Charge of electron (e) = 1.6 × 10^{-19} C

(b)   Mass of electron (m) = 9.1 × 10^{-31} kg

(c)   Planck's constant (h) = 6.6205 × 10^{-34} J.s.

1.   What is probability current ? Show that :   15

$$s = \frac{-i\hbar}{2m}\left[\Psi^{*}\frac{ip}{\hbar}\Psi + \Psi\frac{ip}{\hbar}\Psi^{*}\right].$$

Or

(a)   Explain photoelectric effect in detail.   8

(b)   State De-Broglie hypothesis of matter waves and explain De-Broglie wave velocity.   7

P.T.O.

2.   Obtain Schrodinger wave equation for Hydrogen atom in spherical form using Cartesian coordinate and give the separation of radial part.   15

Or

   (*a*)   Derive an experssion for energy of a particle in one-dimensional box. 8

   (*b*)   Explain momentum quantitation for a particle in one-dimensional box.   7

3.   Write short notes on (any *two*) :   10

   (*a*)   Heisenberg's uncertainty principle

   (*b*)   Eigen values and eigen function

   (*c*)   Particle in one-dimensional box wave function

   (*d*)   Magnetic quantum number.