B—112—2019

FACULTY OF SCIENCE

B.Sc. (Fifth Semester) EXAMINATION
MARCH/APRIL, 2019
(CGPA PATTERN)

PHYSICS

Paper XII (PHY-302)

(Quantum Mechanics)

(Monday, 1-4-2019) **Time : 10.00 a.m. to 12.00 noon**

Time—Two Hours *Maximum Marks—40*

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

(ii) Figure to the right indicate full marks.

(iii) All symbols carry their usual meaning.

1. Attempt any *four* : 8

   (a) State photoelectric effect.

   (b) Write down the expression for uncertainty principle in terms of energy and time.

   (c) Write down Schrodingers equation in time dependent form.

   (d) Define operator in wave mechanics.

   (e) Write down the expression for the energy of a particle in one dimensional box.

   (f) State the permitted values of principal quantum number and orbital quantum number.

2. Solve any *two* : 8

   (a) Derive the expression for compton shift of wavelength due to scattering of electron by photon.

   (b) With the help of uncertainty principle show that electrone does not exist in the nucleus of an atom.

   (c) Explain group velocity and show that for a De Broglie wave group particle velocity and group velocity are equal.

P.T.O.

3. Solve any *two* : 8

   (*a*)   Derive Schrodinger's equation in steady state form.

   (*b*)   Derive the expression for the probability current S and show that $S = |\Psi|^2\, v$.

   (*c*)   Derive the expressions for energy operator E and momentum operator P for a free particle moving along x axis.

4. Solve any *one* : 8

   (*a*)   Derive the expression for the energy of a particle in three dimensional box.

   (*b*)   Write down Schrodinger's wave equation for hydrogen atom in spherical polar coordinates. Using the method of separation of variables, obtain the differential equations for R, Θ and ϕ

5. Write notes on any *two* : 8

   (*a*)   Orbital quantum number

   (*b*)   Magnetic quantum number

   (*c*)   Wave function of a particle in one dimensional box

   (*d*)   G.P. Thomson experiment.