W—96—2018

FACULTY OF SCIENCE

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

OCTOBER/NOVEMBER, 2018

(CBCS Pattern)

PHYSICS

Paper XII

(Quantum Mechanics)

(Monday, 22-10-2018)   Time : 10.00 a.m. to 12.00 noon

Time—2 Hours   *Maximum Marks—40*

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

(ii) Figures to the right indicate full marks.

(iii) *All* symbols have their usual meanings.

(iv) Given data :

$$h = 6.63 \times 10^{-34} \text{ J-s}$$

$$m = 9.1 \times 10^{-31} \text{ kg.}$$

1. Attempt any *four* :   8

(a) Define photo-electric effect and state Einstein's photoelectric equation.

(b) Calculate de-Broglie wavelength of an electron, when it is accelerated by a P.D. of 64 V.

(c) Define operator in wave-mechanics.

(d) Write an equation for energy in case of Hormonic Oscillator.

(e) Write down an expression for probability current.

(f) What is total quantum number ?

P.T.O.

2. Attempt any *two* : 8

    (*a*) Describe G.P. Thomson's experiment for the verification of matter waves.

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

    (*c*) Explain Eigen values and Eigen functions.

3. Attempt any *one* : 8

    (*a*) Explain Compton effect. Obtain an expression for Compton wavelength due to scattering of electron by photon.

    (*b*) Derive the time dependent form of Schrodinger's equation.

4. Attempt any *two* : 8

    (*a*) Derive an expression for wave function of a particle in a one-dimensional box.

    (*b*) Explain orbital quantum number in details.

    (*c*) Write a short note on Momentum quantization when particle is in a one-dimensional box.

5. Attempt any *one* : 8

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

    (*b*) Derive Schrodinger's equation for Hydrogen atom in spherical polar co-ordinates and separate the variables.