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W—97—2018

FACULTY OF SCIENCE

B.Sc. (Fifth Semester) EXAMINATION

OCTOBER/NOVEMBER, 2018

(CGPA Pattern)

PHYSICS

Paper XII (PHY-302)

(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) 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) Give an expression for the change in wavelength associated with a photon in Compton scattering.

(b) State uncertainty principle.

(c) Write an expression for the energy and momentum operator.

(d) Give the significance of $|\psi|^2$.

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

(f) Write the wave function of a particle in a three-dimensional box.

(g) Write an expression for the Schrodinger's equation for hydrogen atom in spherical polar co-ordinates.

P.T.O.

2. Solve any *two* : 8
- (a) Derive an expression for uncertainty principle in terms of position and momentum of a particle.
 - (b) Describe G.P. Thomson's experiment.
 - (c) Calculate the wavelength associated with an electron having momentum 4×10^{-24} kg.m/s.
3. Attempt any *two* : 8
- (a) Derive an expression for the Schrodinger's equation in steady state form.
 - (b) Explain Eigen values and Eigen functions.
 - (c) Derive an expression for energy of a particle in a one-dimensional box.
4. Attempt any *one* : 8
- (a) Derive energy of a particle in a three-dimensional box.
 - (b) Derive an expression for momentum Eigen value and Eigen function for a particle in a one-dimensional box.
5. Write short notes on any *two* : 8
- (a) Separation of variables R, θ , ϕ in H-atom.
 - (b) Orbital quantum number
 - (c) Magnetic quantum number.