

**BIT Sindri**  
**2<sup>nd</sup> Mid-term examination – 2018**  
**Semester I (First year)**  
**Branch – Chemical Engineering.**  
**Paper – Physics I**  
**(Basics of Electricity, Magnetism and Quantum Physics)**

Time –  $1\frac{1}{2}$  hours

Full Marks : 20

Answer five questions from group A and group B. Group A is compulsory.

Group A (Multiple choice questions)

1X4 = 4

Answer any four questions

Q.1

- (i) Compton effect can not take place with  
(a) Visible light (b) X-rays (c)  $\gamma$ -rays (d) X-rays and  $\gamma$ -rays
- (ii) The wavelength of X-rays is of the order of  
(a)  $1\mu\text{m}$  (b) 1micron (c)  $1\text{\AA}$  (d) 1fermi
- (iii) The de-Broglie hypothesis is associated with  
(a) Wave nature of electrons only (b) wave nature of  $\alpha$ -particles only  
(c) wave nature of radiations (d) wave nature of all material particles
- (iv) According to Schrodinger a particle is equivalent to a  
(a) Single wave (b) a wave packet (c) light wave (d) can not behave as wave
- (v) Uncertainty relation can not hold for the following pairs  
(a) Position and momentum (b) energy and time  
(c) linear momentum and angle (d) angular momentum and angle
- (vi) Electrons show the wave behaviour as  
(a) They get diffracted by the crystal (b) they ionize the gas  
(c) they are deflected by the electric field (d) they are deflected by the magnetic field

Group B (Long answer questions)

4X4 = 16

Answer any four questions

- Q.2 What is photoelectric effect? What are laws of photoelectric effect? Deduce Einstein's photoelectric equation. How has photoelectric effect been explained by Einstein?
- Q.3 What is Compton effect? Obtain an expression for Compton shift.
- Q.4 What is de-Broglie wave? Obtain an expression for its wavelength. Find the de-Broglie wavelength of electrons accelerated through  $V$  volts. Describe Davisson and Germer's experiment to show the existence of matter waves.
- Q.5 State and explain Heisenberg uncertainty principle. Give one example to illustrate the principle. Show that electron can not reside inside the nucleus using this principle.
- Q.6 Explain physical significance of wave function. Derive Schrodinger's (i) time dependent and (ii) time independent wave equations.
- Q.7 How crystal behaves as three dimensional grating? Explain Bragg's X-ray diffraction and hence deduce Bragg's law.