Faculty of Engineering & Technology
First Semester B.E. (C.B.S.) Examination
ENGINEERING PHYSICS

Time—Two Hours]

[Maximum Marks—40

INSTRUCTIONS TO CANDIDATES

(1) All questions carry marks as indicated.

(2) Solve **FOUR** questions as follows :

Q.No. **1** OR Q.No. **2**

Q.No. **3** OR Q.No. **4**

Q.No. **5** OR Q.No. **6**

Q.No. **7** OR Q.No. **8**.

(3) Assume suitable data wherever necessary.

(4) Use of Non-programmable electronic calculator is permitted.

List of Constants :

Planck's Constant, h = 6.63 × 10⁻³⁴ J.S.

Velocity of light, c = 3 × 10⁸ m/s

Charge of electron, e = 1.602 × 10⁻¹⁹ C

Mass of electron, m = 9.11 × 10⁻³¹ kg

Avogadro's No. N$_A$ = 6.023 × 10²⁶ atom/Kmol

1. (a) What is Compton effect ? Write expression for Compton shift and explain the existence of modified component and unmodified component in Compton scattering. 4

(b) What is de-Broglie hypothesis ? Show that de-Broglie wavelength for an electron accelerated by an electric field is $\dfrac{12.26}{\sqrt{V}}\overset{\circ}{A}$. 3

(c) X-ray photon of wavelength 0.3 $\overset{\circ}{A}$ is scattered through an angle 40° by a loosely bound electron, find the energy of scattered photon. 3

OR

2 (a) Explain how the observation of Davisson-Germer's experiment justifies the wave nature of matter. 4

(b) Show how the quantization of angular momentum follows the concept of matter waves. 3

(c) A bullet of mass 50 grams and an electron both travel with a velocity of 1000 m/s. What wavelength can be associated with them ? 3

(c) An electron has a speed of 600 m/sec, with an accuracy of 0.005 %. Calculate the uncertainty with which we can locate the position of electron.

2

5. (a) Define the following :

(i) Co-ordination number

(ii) Void space. 2

(b) Show that the FCC structure possesses maximum packing density among the three crystal structures SC, BCC and FCC. 1½+1½+2

(c) The density of copper is 8980 kg/m³ and unit cell dimension is 3.6 Å. Atomic wt. of copper is 63.54. Determine crystal structure and also calculate atomic radius. 3
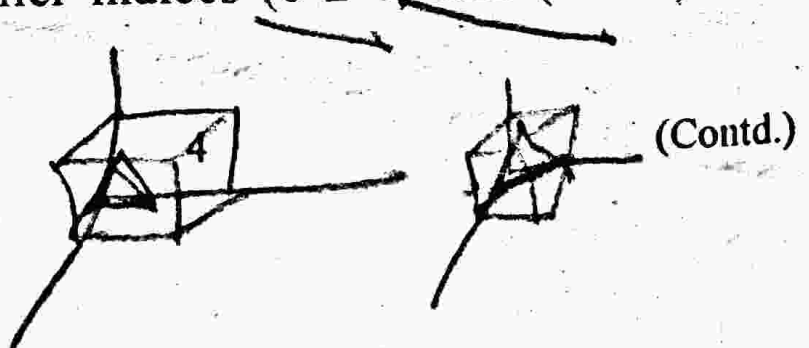
OR

6. (a) Obtain an expression for interplanar spacing between two adjacent planes of Miller indices (hkl) in a cubic crystal. 4

(b) What are Miller indices ? Draw crystal planes having Miller indices (0 2 0) and (2 1 0). 3

(Contd.)

(c) Gold with atomic radius 1.44 Å and FCC structure is being used to determine the wavelength of X-ray. Calculate the wavelength of X-ray if the (1 2 1) plane diffracts the beam by 35°. Assume first order diffraction.

3

7. (a) Explain in brief the concept of Fermi level. Derive an expression for Fermi energy in intrinsic semi-conductor. What is the effect of temperature on Fermi level in an intrinsic semi-conductor ? 4

(b) Obtain an expression for the contact potential (V_0) for P-N junction diode in equilibrium. 3

(c) Calculate the conductivity of pure silicon at room temperature, if :

carrier concentration $= 1.6 \times 10^{10}/m^3$

electron mobility $= 1500 \; cm^2/V. \; sec$

hole mobility $= 500 \; cm^2/V. \; sec.$ 3

OR

8. (a) What is Hall effect ? Derive an expression for Hall voltage and Hall co-efficient for an extrinsic semiconductor. 5

(b) Explain V-I characteristics of Zener Diode. 2

(c) An n-type Ge sample 3 mm wide has electron density of $10^{21}/m^3$. It is arranged in Hall effect experiment having magnetic field 5000 gauss and current density 500 A/m². Find Hall voltage. 3