RVK/KW/13/6549

Faculty of Engineering & Technology

First Semester B.E. (C.B.S.) Examination

ENGINEERING PHYSICS

Paper—II

Time : Two Hours] [Maximum Marks : 40

INSTRUCTIONS TO CANDIDATES

(1) All questions carry equal marks.

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

(i) Q. No. **1** OR Q. No. **2**

(ii) Q. No. **3** OR Q. No. **4**

(iii) Q. No. **5** OR Q. No. **6**

(iv) 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" = 3×10^{8} m/s

Charge on Electron "e" = 1.602×10^{-19} C

Mass of Electron "m" = 9.11×10^{-31} kg.

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1. (a) Obtain an expression for change in wavelength of X-ray photon when it is scattered by an electron at rest. 4

(b) What are the causes of existence of modified and un-modified components in Compton scattering ? 3

(c) A photon of energy 1 MeV is scattered through 90° by a free electron. Calculate the change in energy of photon and electron after the interaction. 3

OR

2. (a) State the properties of matter waves. 2

(b) Discuss in detail an experiment that confirms the existence of de-Broglie matter waves 4

(c) What would be the de-Broglie wavelength associated with :

(i) 2000 kg car having a constant speed of 25 m/s

(ii) 80 kg scooter having a speed of 10 m/s. Give your conclusion. 4

3. (a) What is the Uncertainty Principle ? Is this principle the outcome of the wave description of a particle ? Describe diffraction of Electrons by Single Slit Experiment to prove its validity. 5

(b) Show that the phase velocity of a de-Broglie wave is greater than the velocity of light, but group velocity is equal to velocity of the particle with which the wave is associated. 3

(c) Calculate the minimum uncertainty in the velocity of an electron confined to a box of 10^{-8} m length. 2

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4. (a) A free particle of mass "m" is kept in a rectangular box of length "L". Considering one dimensional motion, obtain an expression of discrete energy of particle. Show that energy of particles are quantized. 5

(b) State the properties of wave function "ψ". 2

(c) Calculate the lowest three permissible energies of an electron if it is bound by an infinite square well potential of width 2.5×10^{-10} m. 3

5. (a) Define atomic radius and packing fraction. Calculate the atomic radii and packing fractions for Body Centered and Face Centered Cubic Unit Cell. 4

(b) What do you understand by Miller Indices of a crystal plane ? Obtain the relation between interplanar spacing and Miller indices of plane in Cubic Unit Cell. 3

(c) For an FCC cubic crystal, the interplanar spacing of (110) plane is 2 Å. Calculate the atomic radius. 3

OR

6. (a) Calculate number of atoms per unit cell in Simple Cubic and Body Centered Cubic Unit Cell. Show that atomic density of BCC is double than SC-unit cell. 3

(b) Derive Bragg's law for X-ray diffraction in crystals. State any one application of it. 4

(Contd.)

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(c) Bragg's Spectrometer is set for the first order reflection to be received by the detector at glancing angle 10°. Calculate the angle through which the detector is rotated to receive the second order reflection from the same face of crystal. 3

7. (a) Discuss energy band structures of conductors, insulators and semiconductors. Give a brief account of the general properties and characteristics of semiconductor. 3

(b) What do you mean by intrinsic semiconductor ? Obtain an expression for the intrinsic carrier concentration in an intrinsic semiconductor. 4

(c) Find the resistance of an intrinsic germanium rod 1 cm × 1 mm × 1 mm at 300 K

For Ge, $n_i = 2.5\times10^{13}$ /cm^3 , $\mu_h = 3900$ cm^2/V.S, $\mu_e = 1900$ cm^2/V.S. 3

OR

8. (a) Draw neat and clean energy band diagrams of PN-junction in :

(i) Unbiased condition

(ii) Forward bias condition. 3

(b) Explain the phenomenon of Hall effect and obtain an expression of Hall voltage developed in rectangular specimen of conductor at equilibrium. 4

(c) The Hall coefficient of certain silicon specimen is found to be -7.5×10^{-5} m^3/c at a certain temperature. If the conductivity is found to be 200 mho/m, calculate density of charge carriers and their mobility. 3

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