B.E. All Branches First Semester (C.B.S.) / B.E. (Fire Engineering) First Semester

Engineering Physics

P. Pages : 2

Time : Two Hours

0969

Max. Marks : 40

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Notes : 1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Assume suitable data whenever necessary.
7. Use of non programmable calculator is permitted.

List of Constants :

1) Plank's Constant 'h'$= 6.63 \times 10^{-34}$ JS

2) Velocity of light $C = 3 \times 10^8$ m/s

3) Avogadro's Constant 'N_A'$= 6.023 \times 10^{26} \dfrac{atoms}{k\ mole}$

4) Boltzmans Constant 'k'$= 1.380 \times 10^{-23}$ J/K

5) Charge of electron 'e'$= 1.602 \times 10^{-19}$ C

6) Mass of electron 'm'$= 9.11 \times 10^{-31}$ kg

1. a) What is Compton Effect? Explain the existence of modified & unmodified component in Compton effect. **1+3**

b) Show that de - Broglie wavelength for an electron is $\dfrac{12.26}{\sqrt{V}} \overset{o}{A}$ where V is the accelerating potential. **3**

c) A bullet of mass 40 gms & an electron both travel with a velocity of 1000 m/sec. What wavelength can be associated with them? Why is the wave nature of bullet not revealed through diffraction effect? **3**

OR

2. a) Explain how the observations of Davisson - Germer experiment justify the wave nature of matter. **5**

b) The x-ray beam is scattered by loosely bound electron at 45° from the direction of beam. The wave length of scattered x-rays is $0.22 \overset{o}{A}$. What is the wavelength of incident x-rays? **3**

c) Why Compton shift is not detectable for the visible range of light? **2**

3. a) State Heisenberg's uncertainty principle & prove that electrons can not reside inside the nucleus. **4**

b) An electron & a bullet (mass = 50 gms) are travelling with the same velocity of 300 m/sec. Assuming an accuracy of 0.01% in velocity measurement. Calculate the accuracy in location of their positions. **3**

	c)	Derive relation between Group velocity and phase velocity for dispersive & non dispersive medium.	**3**

OR

4. a) Show that the wavefunction for a particle confined in a one dimensional potential well of length 'L' & infinite depth is given by $\psi_n(x) = A \cdot \sin\left(\dfrac{n\pi x}{L}\right)$. Hence using normalization condition an 'ψ'. Show that A is given by $\sqrt{\dfrac{2}{L}}$. **5**

b) An electron is confined to move in a one dimensional potential well of length 5A°, find the quantized energy values for the three lowest energy states. **3**

c) Write down : **2**
   i) Schrodinger's time dependent equation.
   ii) Schrodinger's time independent equation in 3 - D.

5. a) For BCC & FCC cell, calculate **4**
   i) Atomic radius in terms of 'a'.   ii) Atomic packing fraction.

b) Draw the following planes in a cubic unit cell. (112), (010) & (120). **3**

c) Nickel crystallizes in a FCC structure. The edge of the unit cell is 3.52A°. The atomic weight of Nickel is $58.710 \, kg/k \, mole$. Determine the density of the metal. **3**

OR

6. a) Derive the mathematical relationship between inter planer distance, Lattice constant & Miller indices for cubic cell. **4**

b) Explain & deduce Bragg's Law for x-ray diffraction. **3**

c) An X-ray of wave length 3A° is diffracted at 40° from (110) plane of cubic crystal. Consider first order diffraction. Find the Lattice constant of the structure. **3**

7. a) What is Hall Effect? With the help of Labelled diagram, obtain the expression for Hall - Coefficient for extrinsic semiconductor. **4**

b) The resistivity of doped Si is $9.27 \times 10^{-3} \, \Omega \, m$ & the Hall coefficient is $3.84 \times 10^{-4} \, m^3/c$. Assuming that conduction is by a single type of charge carrier, Calculate the density and mobility of the carrier. **4**

c) Draw energy band diagram of pnp transistor in unbiased mode. **2**

OR

8. a) What is Fermi function? Draw a graph showing its variation with energy at different temperature & discuss it. **4**

b) In a n - p - n transistor connected in common base configuration, emitter current is 2 mA and base current is $20 \mu A$, what are the values of collector current and current gain? **3**

c) Explain the terms : **3**
   i) Drift Current   ii) Diffusion Current.

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