B.E. First Semester (Fire Engineering) (C.B.S.)

Engineering Physics Paper - II

P. Pages : 2 **TKN/KS/16/7285**

Time : Two Hours * 0 8 5 3 * Max. Marks : 40

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. Illustrate your answers whenever necessary with the help of neat sketches.
8. Use of non programmable calculator is permitted.

List of Constants

Planck's constant $h = 6.6 \times 10^{-34}$ J.S

Velocity of light $c = 3 \times 10^{8}$ m/s

Charge on electron $\bar{e} = 1.6 \times 10^{-19}$ C

1electron volt (ev) $= 1.6 \times 10^{-19}$ J

Boltzmann constant $k = 1.38 \times 10^{-23}$ J/K

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

Avogadro's number $N_A = 6.23 \times 10^{26} \frac{\text{Atoms}}{\text{k mole}}$

1. a) State the expression for Compton shift. Explain the existence of Modified component in Compton scattering. **1+2**

b) Explain how de-Broglie hypothesis regarding wave nature of matter leads to Bohr's quantization condition for angular momentum of an electron. **4**

c) In Compton effect, a photon is scattered by a free electron at rest through an angle of 90º. What is the energy of scattered photon if the wavelength of incident photon is 12nm. **3**

OR

2. a) Explain Davisson Germer experiment to show the wave like character of a beam of electrons. **4**

b) Obtain an expression of de-broglie's wavelength for an electron accelerated through a region of potential difference of "V" volt. **3**

c) Find the de Broglie wavelength of: **3**
i) An electron accelerated through a potential difference of 144V.
ii) 10gm object moving with a speed of 10m/s

3. a) State Heisenberg's uncertainty principle. **2**

b) Prove that electron can not exist inside the nucleus. Given- Radius of nucleus $= 10^{-14}$m and Maximum Kinetic energy of an electron inside an atom = 4 Mev. **3**

c) Define Phase velocity and Group velocity. Obtain relation between them. Give its significance. **2+3**

OR

4. a) Show that the wave function for a particle confined to move in infinite one-Dimensional potential well of length L is given by $\psi_n(x) = \sqrt{\frac{2}{L}} \sin\left\{\frac{n\pi x}{L}\right\}$. **5**

b) State properties of wave function "ψ". **2**

c) 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**

5. a) Define : **3**
i) Atomic packing fraction. ii) Coordination number
iii) Unit cell

b) Show that FCC structure has maximum packing density among all cubic cell. **4**

c) Silver has FCC structure and the atomic radius is 1.441A°. Calculate the density of silver. Atomic weight of silver is 108. **3**

6. a) Derive the relation between lattice constant and interplanar spacing in cubic unit cell. **4**

b) Derive Bragg's Law for diffraction of x-rays from crystal planes. **3**

c) Lead is FCC crystal with atomic radius of 1.746A°. Find the spacing of (200) and (120) planes. **3**

7. a) Explain the formation of depletion region in a p-n junction diode. **3**

b) Draw energy band diagram for p type semiconductor at O°k and T°k. **2+2**

c) Calculate the fraction of electron in conduction band of diamond at 27°C if Band Gap is 5.6ev. **3**

OR

8. a) What is Hall effect? Obtain an expression for Hall coefficient for a specimen having only one type of charge carriers. **4**

b) Explain V-I characteristics of Zener diode. **2**

c) In a Hall effect experiment, a current of 2.5mA is sent through a metal strip having thickness 0.2mm and width 5mm. The Hall voltage is found to be 0.15mV; when a magnetic field of 2000 Gauss is used. **4**
Find: 1) Carrier concentration 2) Drift velocity of the carrier.

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