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

# Engineering Physics Paper - II

P. Pages : 2 **KNT/KW/16/7197**

Time : Two Hours * 0 6 3 1 * 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

Planck's constant $h = 6.63 \times 10^{-34}$ J.S.
Velocity of light $c = 3 \times 10^{8}$ m/s
Charge of electron $e = 1.602 \times 10^{-19}$ C
Mass of electron $m = 9.11 \times 10^{-31}$ kg
Avogadro's No $N_A = 6.023 \times 10^{26}$ atoms/ kmole
Boltzmann constant $K = 1.38 \times 10^{-23}$ J/K

**1.** a) What is Compton effect? Write expressions for the conservation of energy and momentum for Compton scattering. **3**

b) Why intensity of modified wavelength ( $\lambda'$ ) is higher than that of unmodified wavelength ( $\lambda$ ) for low atomic no. Scatterer during Compton Scattering? **3**

c) X-rays of 1 $\mathring{A}$ wavelength are scattered from a carbon block making an angle of $50^{o}$ with the direction of incident photon Calculate wavelength of scattered photon and energy of recoil electrons. **4**

**OR**

**2.** a) What are matter waves? Obtain an expression for de Broglie wavelength associated with an electron moving through a region of 'V' volts potential. **3**

b) Obtain Bohr's Quantization condition of an angular momentum from de- Broglies hypothesis. **3**

c) Calculate de Broglie wavelength for **4**
i) An electron having velocity $10^{5}$ m/s and
ii) A Ball having mass 1 kg and moving with velocity of 10 m/s Interpret the results.

**3.** a) Using Schrodinger's time independent wave equation, obtain an expression for energy states of electron trapped in an infinite potential well of width 'L' **5**

b) State physical significance of wave function ( $\psi$ ). **2**

c) Find two lowest energy states of an electron trapped in an infinite potential well of width 2 $\mathring{A}$ Express results in electron-volt. **3**

**OR**

**4.** a) State Heisenberg's uncertainty principle and prove that electron can not be present inside nucleus of an atom. **4**

b) Define phase velocity and group velocity. Also explain the formation of wave packet. **4**

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

**5.** a) Define the followings. **2**

i) Unit cell
ii) Miller indices of a plane

b) Obtain the following parameters for BCC & FCC cubic unit cell. **4**

i) Atomic radius
ii) Packing fraction.

c) Lattice constant for BCC iron at 20º C is 2.80 Aº. Density of Iron is 7870 kg/$m^3$ Determine its atomic mass and radius. **4**

**OR**

**6.** a) State and derive Bragg's law of x-ray diffraction. **4**

b) Draw crystal planes in a cubic crystal for given miller Indices: **3**
i) (221)
ii) (001)
iii) (320)

c) Find the spacing of (212) and (030) planes in a FCC crystal having lattice constant of 5 Å and also find radius. **3**

**7.** a) Explain the formation of hall voltage in an extrinsic semiconductor and obtain the expression of Hall coefficient. **4**

b) How, depletion region is formed across the Junction of a diode? **3**

c) Find barrier potential across a silicon PN junction at room temperature, if P-region has $10^{21}$ acceptor atoms/$m^3$ and N-region has $10^{22}$ donor atoms/$m^3$ (Given that $n_i = 1.5 \times 10^{16}$ carriers/$m^3$) **3**

**OR**

**8.** a) Why Base region is narrow and lightly doped in transistor? Explain. **3**

b) Draw energy band diagrams for **4**

i) PN Junction in Reverse Bias
ii) PNP Transistor biased in CB mode.

c) Find d. c. current gain for a pnp transistor in common emitter mode if collector current is 2 mA and base current is 20 μ A. **3**

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