B.Tech. / B.E. (Model Curriculum) Semester-I & II

BSC101 – Physics

P. Pages : 3 **GUG/W/24/13165**

Time : Three Hours * 4 9 9 3 * Max. Marks : 80

Notes : 1. All questions carry equal marks.
2) Due credit will be given to neatness and adequate dimensions.
3) Assume suitable data wherever necessary.
4) Diagram and chemical equation should be given wherever necessary.
5) Illustrate your answer wherever necessary with the help of neat sketches.
6) Use of non-programable calculator is permitted.

List of constants:

1) Plank's constant, $h = 6.634 \times 10^{-34}$ Js.
2) Free space permittivity, $\varepsilon_0 = 8.85 \times 10^{-12}$ F/m.
3) Mass of electron, $m_e = 9.1 \times 10^{-31}$ Kg.
4) Charge on electron, e = l.602xl0^{-19} C.
5) Velocity of light, $c = 3 \times 10^8$ m/s.

1. a) What is de-Broglie Hypothesis and Explain Davisson-Germer experiment. **6**

b) Define Phase velocity and Group velocity and derive the relation between them. **6**

c) Find the de-Broglie wavelength of a 1 kg of object moving with speed 1 m/s. **4**

OR

2. a) Write down a Schrodinger time independent wave equation for matter waves. Hence obtain the expression for energy of a particle in one dimensional potential well of infinite height. **6**

b) i) Write a short note on wave packet. **3**

ii) What are the physical significance of wave function. **3**

c) An electron is confined to move between two rigid walls separated by 10 A°. Find the first two allowed energy states of the electron. **4**

3. a) Draw energy level diagram for Si. **6**

b) Show that the fermi level E_F lies exactly midway between conduction band and valence band in intrinsic semiconductor. **6**

c) Estimate the fraction of electron in the conduction band at 300K of **4**
i) Germanium (Eg = 0.72 eV)
ii) Silicon (Eg = 1.1 e V).

OR

4. a) Draw energy band diagram for p-n junction when biased and unbiased. **6**

b) Derive an expression for the height of barrier potential. **6**

c) Find the resistivity of intrinsic germanium at 300K. Given that the intrinsic density of carrier is $2.5x10^{19}/m^3$, electron mobility is 0.39 m^2/V.sec and hole mobility is 0.19 m^2/V.sec. **4**

5. a) Write a short note on capacitance of the capacitor. **6**

b) Derive an expression for electronic polarization. **6**

c) If a NaCl crystal subjected to an electric field of 1000 V/m and the resulting polarization is $4.3xl0^{-8}$ cm^2, calculate the relative permittivity of NaCl. **4**

OR

6. a) Write short note on polar and non polar dielectric. **6**

b) Derive Clausius-Mosotti equation. **6**

c) Calculate the electronic polarizability of argon atom. If $\varepsilon_r = 1.0024$ at NTP and $N = 2.7x10^{25}$ atoms/m^3. **4**

7. a) What do you understand by antireflection coating? Deduce an expression for minimum thickness of antireflection coating. **6**

b) In a Newton's ring experiment why **6**

i) The planoconvex lens should have large radius of curvature.

ii) All the rings are not evenly spaced.

iii) The fringes are circular.

c) Fringes of equal thickness are observed in a thin glass wedge of refractive index 1.52. The fringe spacing is 0.1mm, wavelength of light being 5893A°. Calculate the wedge angle. **4**

OR

8. a) Draw the block diagram of a CRO. Explain the working of Trigger Circuit. **6**

b) Explain with the help of labelled diagram the concept of cross fields. **6**

c) An electron is accelerated through a potential difference of 5 kV and enter uniform magnetic field of 20Wb/m^2 acting normal to the direction of electron motion. Determine radius of the path. **4**

9. a) Explain 3 level and 4 level pumping scheme. For stimulated emission why 2 level pumping scheme is not used. **6**

b) Explain construction and working of He-Ne laser with the help of energy level diagram. **6**

c) A laser beam can be focus on an area equal to the square of its wavelength (λ) . for a He-Ne laser, $\lambda = 6328\,\mathring{A}$. If the laser radiates energy at the rate of 1 mW, find out the intensity of focused beam. **4**

OR

10. a) Explain the phenomenon of total internal reflection of light. Define critical angle. **6**

b) Deduce the expression for acceptance angle of an optical fiber. **6**

c) Numerical aperture and refractive index of core of an optical fiber are respectively 0.2441 and 1.5. Find refractive index of cladding and acceptance angle. **4**

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