B.E (Model Curriculum) Sem-I & II

BSC101 - Physics

P. Pages : 3 **GUG/W/22/13165**

Time : Three Hours Max. Marks : 80

Notes : 1. All questions carry equal marks
1. Due credit will be given to neatness and adequate dimensions.
2. Assume suitable data wherever necessary.
3. Illustrate your answers wherever necessary with the help of neat sketches.
4. Instruments, Charts and Refrigeration charts is permitted. Use of non programmable / scientific calculator is permitted.

List of constant:

i) Planck's constant = 6.632×10^{-34} J.s

ii) Baltzmann constant $= 1.38\times10^{-23}$ J / k

$= 8.61\times10^{-5}$ ev / k

iii) Permittivity of free space $= 8.85\times10^{-12}$ F / m.

1. a) State the properties of matter waves. **6**

b) Explain de – Broglie concept of matter waves. Using the concept of matter waves, obtain the Bohr's condition for quantization of angular momentum. **6**

c) Calculate de – Broglie wavelength of proton whose kinetic energy is equal to the rest energy of an electron. The mass of proton is 1836 times that of an electron. **4**

OR

2. a) Explain physical significance of wave function Ψ . State the conditions imposed on a well behaved wave function.

b) Deduce the acceptable values of energy for an atoms in solids executing harmonic vibrations. **4**

c) Compare the lowest three energy states for (i) an electron confined in the infinite potential well of width 10A^o And (ii) a grain of durt $\left(m = 10^{-6} gm\right)$ moving with a speed of 10^6 m / s in an infinite potential well of width 0.1 mm.

3. a) Draw band diagram for a PNP transistor and explain how the band alignment changes when it is biased in active region. **6**

b) Explain formation of depletion layer near the PN junction. Show that the height of depletion layer is given by

$$eV_o = KT \log_e \left[\frac{N_D N_A}{{n_i}^2} \right]$$

c) Calculate the conductivity of extrinsic silicon at room temperature if the donor impurity added is 1 in 10^8 silicon atoms. **4**

OR

4. a) State probability distribution function. Explain its dependence on temperature. **6**

b) Explain formation of energy bands in silicon. **6**

c) Find the barrier potential across a silicon P – N junction at room temperature, if p region has 10^{21} acceptor atoms / m^3 and n – region has 10^{22} atoms/ m^3. **4**
Given : $n_i = 1.5 \times 10^{16} / m^3$

5. a) Derive Clausius – Mosotti equation for a solid dielectric which exibits only electronic polarizability. **6**

b) Write a short note on polar and nonpolar dielectrics. **6**

c) If a NaCl crystal is subjected to an electric filed of 1000 v/m and the resulting polarization is $4.3 \times 10^{-8} cm^2$, calculate the relative permittivity of NaCl. **4**

OR

6. a) Explain the terms. **6**
i) Induced charges.
ii) Dielectric susceptibility
iii) Polarizability of dielectric

b) Give the relationship between $\vec{E}, \vec{D}$ and $\vec{P}$. What is the significance of each of these vectors. **4**

c) Explain how polarization is induced in a dielectric material in presence of electric field. **6**

7. a) 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

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

c) A parallel beam of light of wavelength 5890 A^o. Strikes a film of oil floating on water. When viewed at an angle of 30º from the normal. Determine the thickness of film if refractive index of oil is 1.46. **4**

OR

8. a) How a charged particle can be made to travel along helical path in an uniform magnetic field? Obtain an expression for pitch of helix. **6**

b) Explain the principle and working of Bainbridge mass spectrograph. What are its uses? **6**

c) An electron is accelerated through a potential difference of 5 kV and enter uniform magnetic field of $0.02 Wb/m^2$ 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) Describe construction and working of semiconductor laser. **6**

c) Explain the terms special coherence and temporal coherence of height waves. **4**

OR

10. a) What is the difference between step index fibre and graded index fibre? What are the advantages of optical fibre cable over conventional one. **6**

b) Explain total internal reflection phenomena in detain. Explain how optical fibre can be used as liquid level detector. **6**

c) For a step index fibre with a core of refractive index 1.54 and cladding of refractive index 1.52. Calculate fractional refractive index change and numerical aperture. **4**

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