B.Tech. (Model Curriculum) Sem-I

BSC101 - Physics

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

Time : Three Hours * 3 6 9 6 * 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. Diagrams and Chemical equation should be given wherever necessary.
5. Illustrate your answers wherever necessary with the help of neat sketches.
6. Use of non programmable calculator is permitted.

List of Constants:

1) Planck's constant = 6.634×10^{-34} js
2) Free space permittivity $\varepsilon_0 = 8.85\times10^{-12}$ F / m
3) Mass of electron $(m_e) = 9.11\times10^{-31}$ kg
4) Charge on electron $(e) = 1.602\ 8\ 10^{-19}$ C
5) Velocity of light $(c) = 3\times10^{8}$ m / s

1. a) State de-Broglie hypothesis. Using this concept of matter waves, Obtain the Bohr's condition for quantization of angular momentum. **6**

b) State and explain Heisenberg's Uncertainty Principle. Obtain an expression by thought experiment. **6**

c) Find the de-Broglie wavelength of: **4**
i) an electron accelerated through a potential difference of 182 volts.
ii) a 1 kg object moving with a speed of 1 m/s.

OR

2. a) Explain the concept of wave packet. Explain about well behaved wave function and write its properties. **6**

b) Write the Schrodinger's time independent and time dependent wave equations. Obtain the expression for energy values of nth particle in one dimensional potential well of infinite height. **6**

c) An electron and a 150 gm baseball are travelling 220 m/s measured to an accuracy of 0.065%. Calculate and compare uncertainty in position of each. **4**

3. a) Explain the classification of conductors, semiconductors and insulators on the basis of band theory. **6**

b) Show that Fermi level lies midway between valence band and conduction band in intrinsic semiconductors. **6**

c) Calculate the conductivity of pure silicon at room temperature, Given carrier concentration = 1.6×10^{10} / c.c . Electron mobility $= 1500\,cm^2$ / V.sec and hole mobility $= 500\,cm^2$ / V.sec . **4**

OR

4. a) Draw a neat labelled energy band diagram for PNP transistor showing circuits when **6**

i) Unbiased

ii) Biased in common base mode.

b) i) What is pn – junction? What is its important property? **6**

ii) What is meant by potential barrier?

iii) What is meant by depletion layer?

c) Calculate the probabilities for an electronic state to be occupied at 20ºC, if the energy of these states lies 0.11 eV above and 0.11 eV below the Fermi level. **4**

5. a) i) What are linear dielectrics? Why are they called Passive dielectrics? **6**

ii) What are non – linear dielectrics? Why are they called Active dielectrics?

b) Derive Clausius – Mossotti relation in dielectrics. **6**

c) Find the total Polarization CO_2, if its susceptibility is 0.985×10^{-3} and density is $1.977\,kg/m^3$. **4**

OR

6. a) Explain the origin of direct piezoelectric effect and inverse piezoelectric effect? **6**

b) Discuss the applications of piezoelectric and ferroelectric materials. **6**

c) An elemental dielectric material has $\varepsilon_r = 12$ and it contains 5×10^{28} atoms / m^3. Calculate its electronic polarizability assuming Lorentz field. **4**

7. a) What is thin film? Obtain conditions for maxima and minima due to interference of reflected light in a thin film of uniform thickness. **6**

b) Derive Expression for deflection of electron beam in transverse magnetic field. **6**

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 5893Aº. Calculate the wedge angle. **4**

OR

8. a) Draw the block diagram of cathode ray oscilloscope (CRO) and briefly describe the function of its principle parts. **6**

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

c) An electron having velocity 10^6m/s experiences a maximum force of $1.6\times10^{-14}\text{N}$, when it enters a uniform magnetic field. What is the magnitude of the magnetic field. **4**

9. a) Distinguish between: **6**

1) Spontaneous stimulated emission

2) Three level and four level lasers.

b) Explain the working of Ruby Laser with the help of neat labelled energy level diagram. **6**

c) Compute the coherence length of yellow light with 5893 A^o in 10^{-12} sec. pulse duration. Also find bandwidth. **4**

OR

10. a) Explain the phenomenon of total internal reflection of light. How it is used in fiber optic communication. **6**

b) Derive expression for acceptance angle and numerical aperture for 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**

****