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

BSC101 - Physics

P. Pages : 3 **GUG/W/23/13165 (S)**

Time : Three Hours * 8 3 3 8 * Max. Marks : 80

Notes : 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. Use of non programmable/scientific calculator is permitted.

Planks constant $h = 6.634 \times 10^{-34}$ J.S.

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

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

Charge on electron $= 1.602 \times 10^{-19}$ C

Mass of electron $m = 9.1 \times 10^{-31}$ kg

Charge on alpha particle $= 3.2 \times 10^{-19}$ C

Mass of alpha particle $m = 6.68 \times 10^{-27}$ kg

1. a) Explain the concept of Bohr's Quantization of angular momentum. **6**

b) What is wave function? Gives physical interpretation of wave function. **6**

c) An electron traveling at 3.9×10^{5} m / s has an uncertainty in its velocity of 1.15×10^{5} m / s. What is the uncertainty in its position? **4**

OR

2. a) Explain the concept of wave packet? Derive the relation between Group velocity and Phase velocity. **2+4**

b) What is linear harmonic oscillator? Explain in details. **6**

c) Calculate the wavelength associated with 1MeV proton. **4**

3. a) Explain the formation of energy bands in solid on the basis of band theory. **6**

b) Differentiate the materials on the basis of band theory and explain it with necessary diagram. **6**

c) A semiconductor has a conductivity $250\,\Omega$ / m at 20ºC and $1100\,\Omega$ / m at 100ºC. Determine its energy band gap value. **4**

OR

4. a) Explain the effect of temperature and doping concentration on Fermi energy level in an extrinsic semiconductor. **6**

b) In transistor, explain why : **6**
- i) Base is thin narrow and lightly doped
- ii) Emitter is heavily doped
- iii) Collector has larger area

c) Determine the fraction of electron in conduction band in silicon at 27ºC and 227ºC. [Given that, $E_g = 1.12eV$] **4**

5. a) What is dielectrics? Explain various types of polarization occurs in dielectrics. **6**

b) Derive the equation for internal field in dielectrics. **6**

c) Differentiate between ferroelectric and piezoelectric materials. **4**

OR

6. a) Explain piezoelectric effect and inverse piezoelectric effect. **6**

b) Define **6**
- i) Induced dipole
- ii) Permanent dipole
- iii) Dielectric Constant

c) Determine the electric susceptibility at 0ºC for a gas whose dielectric constant at 0ºC is 1.000041. **4**

7. a) What is interference? Explain in term **6**
- i) Interference due to division of amplitude
- ii) Interference due to division of wavefront

b) In Newton's ring experiments, what happened when? **6**
- i) Sodium light is replaced with white light
- ii) Plano convex lens is replaced by plane mirror
- iii) Radius of curvature of lens is kept small

c) In a Newton's ring experiment, the diameter of the 20^{th} dark ring was found to be 5.82 mm and the 10^{th} ring is 3.36 mm. If the radius of the plano convex lens is 1m, calculate the wavelength of light used. **4**

OR

8. a) What is Cathode Ray Oscilloscope? Explain the function of vertical deflecting plates and horizontal deflecting plates in CRO. **6**

b) Explain the principle and working of Bainbridge mass spectrograph. **6**

c) A beam of electrons moving with constant velocity in a region having electric and magnetic field of strength 20 V/m and 0.5 T at right angle to the direction of motion of electrons. Determine the velocity of electrons. **4**

9. a) Explain construction and working of Ruby Laser. **6**

b) Explain the term **6**
- i) Spatial Coherence
- ii) Temporal Coherence
- iii) Population Inversion

c) Explain the various applications of laser. **4**

OR

10. a) What is an optical fiber? Give the basic principle of light guidance through the optical fiber. **6**

b) Define acceptance angle and numerical aperture and hence derive mathematical relation between them. **6**

c) Find the numerical aperture of an optical fiber, whose core and clad have refractive index 1.46 and 1.45 respectively. **4**

****