

Lib

Physics (2 Hours) Physics

[Total Marks : 75]

- N. B. : (1) Question No. 1 is **compulsory**.  
 (2) Attempt any **four** questions from Q. No. 2 to 7.  
 (3) Assume **suitable** data and symbols if **required**.  
 (4) Figures to **right** indicate **full** marks.

1. Attempt any **five** :— 15
- Draw the following planes and directions in cubic cell. (101), (100), [111]
  - Define superconductivity and explain critical magnetic field.
  - Explain measurement of frequency of a.c. signal using CRO.
  - Explain cavitation effect and give its two applications.
  - Define mobility of charge carrier and state its S.I. unit.
  - What are liquid crystals ? State its different phases.
2. (a) Explain atomic arrangement in diamond structure and calculate. 10
- Total number of atoms per unit cell (n)  
 Atomic radius (r)  
 Co-ordination number (CN)  
 Atomic packing factor (APF)  
 Packing efficiency (PE)  
 Void space and density
- Also write the materials exhibiting diamond structure.
- (b) The critical field of niobium is  $1 \times 10^5$  A/m at 8°k and  $2 \times 10^5$  A/m at 0°k. Calculate critical temperature of the element. 5
3. (a) Explain formation of energy bands in solid and classify the solids on the basis of energy band diagram. 10
- A copper strip 2 cm wide and 1mm thick is placed in a magnetic field with  $B = 1.5$  wb/m<sup>2</sup>. If current of 200A is set up in the strip, calculate Hall Voltage that appears across the strip. (Given :  $R_H = 6 \times 10^{-7}$  m<sup>3</sup>/C)
- (b) Molybdenum has a BCC structure. Its density is  $1.02 \times 10^4$  kg/m<sup>3</sup> and its atomic weight is 95.94. Determine the radius of molybdenum atom. 5
4. (a) Derive Bragg's law. Explain Bragg's Spectrometer and its use to analyze crystal structure. 10
- (b) Two ships are anchored at some distance from each other. An ultrasonic signal is sent by two routes through water and air. The difference between times at which the signals reach the other ship is 2 seconds. If velocity of sound in air and water is 348 m/s and 1392 m/s respectively, find distance between the ships. 5
5. (a) Explain the structure of naturally occurring quartz crystal. 10
- With neat circuit diagram explain production of Ultrasonic waves by Piezo-electric oscillator.
- (b) A classroom has dimensions 20x15x5 m<sup>3</sup>. The reverberation time is 3.5 sec. Calculate the total absorption of surface and average absorption. 5

6. (a) What are Lissajous figures ? Explain how they are used to measure unknown frequency. 10

An electron travels with a velocity of  $2.5 \times 10^6 \text{ m/s}$  in a uniform magnetic field strength of  $0.94 \times 10^{-4} \text{ wb/m}^2$ , such that velocity vector makes an angle of  $30^\circ$  with the field direction. Determine the distance covered along the magnetic field direction in its one revolution.

- (b) Distinguish between Type-I and Type-II superconductors. 5

7. (a) State the acoustic requirements of a good auditorium. Explain how these requirements can be achieved. 10

- (b) If P.D. across an X-ray tube is 25kV and filament current is 10mA. Calculate number of electrons striking the target per second and velocity of electrons striking the target. 5
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