



Applied Physics -I Dec 17

First Year (Semester 1)

Total marks: 80

Total time: 3 Hours

INSTRUCTIONS

- (1) Question 1 is compulsory.
- (2) Attempt any **three** from the remaining questions.
- (3) Draw neat diagrams wherever necessary.

Q1) Attempt any five

(15 marks)

- (a) 'Crystal act as three dimensional grating for X-rays', explain
- (b) Calculate the frequency and wavelength of photon whose energy is 75eV.
- (c) Draw the energy band diagram of p-n junction diode in forward and reverse bias condition
- (d) "Superconductor is a perfect diamagnetic", explain.
- (e) What is reverberation time? How is it important? Write the factors affecting reverberation time.
- (f) A quartz crystal of thickness 1.5mm is vibrating with resonance. Calculate its fundamental frequency if the Young's modulus of quartz crystal is $7.9 \times 10^{10} \text{N/m}^2$ and density is 2650 kg/m^3
- (g) Mobility's of electron and hole in a sample of Ge at room temperature are $0.36 \text{ m}^2/\text{V-sec}$ and $0.17 \text{ m}^2/\text{V-sec}$ respectively. If electron and hole densities are equal and it is $2.5 \times 10^{13} / \text{cm}^3$, calculate its conductivity.

2(a) With Heisenberg's uncertainty principle prove that electron cannot survive in nucleus. An electron has a speed of 300m/sec. with uncertainty of 0.01%. Find the accuracy in its position. (8 marks)

2(b) Show that Fermi energy Level in intrinsic semiconductor is at the Center of forbidden energy gap. (7 marks)

3(a) With neat diagram of unit cell, explain the structure of HCP crystal and calculate the no. of ions per unit cell, coordination no., lattice constant and packing factor of the structure. (8 marks)

3(b) State the Hall Effect. Drive the expression for Hall voltage and Hall coefficient with neat diagram. (7 marks)



- 4(a)** What is the working principle of Maglev? Explain how it can acquire high speed? (5 marks)
- 4(b)** A hall of dimensions $25 \times 18 \times 12 \text{ m}^3$ has an average absorption coefficient 0.2. Find the reverberation time. If a curtain cloth area 150 m^2 is suspended at the Center of hall with coefficient of absorption 0.75, what will be the reverberation time? (5 marks)
- 4(c)** State the piezoelectric effect. With neat circuit diagram explain the principle and working of piezoelectric oscillator. (5 marks)
- 5(a)** With energy band diagram, explain the variation of Fermi energy level with temperature in extrinsic semiconductor. (5 marks)
- 5(b)** Explain with example how to determine crystal structure by Bragg's X-ray spectrometer. (5 marks)
- 5(c)** Obtain one dimensional time dependent Schrodinger equation. (5 marks)
- 6(a)** Define ligancy and critical radius ratio. Calculate critical radius ratio for ligancy (5 marks)
- 6(b)** What is the significance of wave function? Drive the expression for energy Eigen values for free particle in one dimensional potential well. (5 marks)
- 6(c)** What is photovoltaic effect? Explain the principle and working of Solar cell. (5 marks)