

BACHELOR OF TECHNOLOGY (C.B.C.S.) (2021-COURSE)
B. Tech. Sem - I MECHANICAL : WINTER- 2022
SUBJECT : WAVES & SOLID STATE PHYSICS

Day : Wednesday

Time : 10:00 AM-01:00 PM

Date : 11/1/2023

W-24058-2022

Max. Marks : 60

N.B :

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Use of non-programmable **CALCULATOR** is allowed.
- 4) Draw neat and labeled diagram **WHEREVER** necessary.
- 5) Assume suitable data if necessary.

Constants :

$$\begin{aligned} e &= 1.6 \times 10^{-19} \text{ C} \\ m_e &= 9.1 \times 10^{-31} \text{ Kg} \\ h &= 6.63 \times 10^{-34} \text{ J-s} \\ m_p &= 1.67 \times 10^{-27} \text{ Kg} \\ N_a &= 6.025 \times 10^{23} \text{ atoms/gm-mole} \\ c &= 3 \times 10^8 \text{ m/sec} \end{aligned}$$

Q.1 Obtain the condition for principal maxima and minima in Fraunhofer (10)
diffraction due to single slit.
Find the angle of diffraction in first order if a light of wavelength
 7×10^{-5} cm incident normally on the plane transmission grating of width 4
cm having 17000 lines.

Q.1 Discuss : (10)
i) Double refraction in Calcite crystal
ii) Dichroism in Tourmaline crystal

Q.2 Discuss the characteristics properties of LASER and explain construction (10)
and working of single Hetero-junction laser.

Q.2 Explain the formation of LASER speckles and construction and working of (10)
He-Ne laser.

Q.3 Discuss Fermi Dirac probability function and show that $E_f = \frac{E_c + E_v}{2}$ for (10)
intrinsic semiconductor.

Q.3 What is Hall effect? Derive an expression for Hall voltage and Hall (10)
coefficient.

A copper strip 2.0cm wide and 1 mm thick is placed in a magnetic field with
 $B = 1.5 \text{ wb/m}^2$. If a current of 250 A is setup in the strip, calculate Hall
voltage that appears across the strip.
Given $R_H = 6 \times 10^{-6} \text{ m}^3/\text{C}$

Q.4 What are nanoparticles? Explain electrical, magnetic and mechanical (10)
properties of nanoparticles that differ from bulk form.

Q.4 What are quantum dots? Explain synthesis of nanoparticles by chemical (10)
method and growth by LAMER diagram.

P.T.O.

Q.5 Explain various modes of operation and working of atomic force microscope (AFM). (10)

OR

Q. 5 Explain focusing of charged particles by electric and magnetic field. (10)
A beam of electron accelerated through a potential difference of 1500 volts enters perpendicular magnetic field of 100×10^{-3} wb/sqm. Find the radius of curvature of the beam.

Q.6 Write a note on : (10)
i) Electro and magneto rheological fluids
ii) Active smart polymers

OR

Q. 6 What are persistent currents in Superconductors? Discuss Type-I and Type – II Superconductors. (10)

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