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

Day : Wednesday | Time : 10:00 AM-01:00 PM

Date : 11/1/2023 | **W-24118-2022** | 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 :

$e = 1.6 \times 10^{-19}$ C
$m_e = 9.1 \times 10^{-31}$ Kg
$h = 6.63 \times 10^{-34}$ J-s
$m_p = 1.67 \times 10^{-27}$ Kg
$Na = 6.025 \times 10^{23}$ atoms/gm-mole

Q.1 Discuss dichroism in tourmaline crystal and explain construction and working of Nicol prism for the production of polarized light. **(10)**

OR

Q.1 Distinguish between Fraunhofer and Fresnel diffraction. A light of wavelength 5×10^{-5} cm incident normally on plane transmission grating of width 3 cm having 14000 lines. Find the angle of diffraction in first order. **(10)**

Q.2 With neat labelled diagram explain construction and working of CO_2 laser. Discuss the role of He atoms in CO_2 laser. **(10)**

OR

Q.2 What is stimulated emission and population inversion in laser. Explain construction and working of He-Ne laser. **(10)**

Q.3 With neat and labelled diagram, explain the band structure of p-n junction diode under forward and reverse biasing. **(10)**

OR

Q.3 Derive the expression for conductivity in semiconductors. Discuss intrinsic and extrinsic cases. Calculate the number of acceptor atoms to be added to germanium sample to obtain the resistivity of 11 Ω-cm.
Given $\mu_p = 1500$ cm^2/volt-sec. **(10)**

Q.4 Write a note on quantum dots and explain the synthesis of nanoparticles by physical method. **(10)**

OR

Q.4 Explain the synthesis of nanoparticles by colloidal route method and growth of nanoparticles by Lamer diagram. **(10)**

Q.5 Explain various parts, it's function and working of Scanning electron microscope (SEM). **(10)**

OR

Q. 5 Write a note on : **(10)**
i) Velocity selector ii) Magneto-static focusing
Calculate force on electron and its acceleration if it starts from rest and moves freely in an electric field of E= 50 kV/m

Q.6 Discuss in detail **(10)**
i) Meissner effect ii) Persistent current

OR

Q. 6 Explain the two phases and two unique properties of shape memory alloys (SMA). **(10)**

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