Code: 20A56201T

R20

B.Tech I Year I Semester (R20) Regular Examinations August/September 2021

APPLIED PHYSICS

(Common to EEE & ECE)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Why are the circular fringes obtained in Newton's rings experiment?

(b) Two Nicolprism are adjusted to be in the crossed position. One of the two Nicol is then rotated through 30°. Estimate the fraction of increase or decrease of intensity.

(c) What do you mean by metastable state? Why is it essential for lasing action?

(d) Why the refractive index of core must be greater than that of cladding in an optical fibre?

(e) What do you mean by polar dielectrics? Give an example of polar dielectrics.

(f) The magnetic susceptibility of copper subjected to magnetic field of 10^6 A/m is -0.8 x 10^{-3}. Calculate the magnetization and magnetic flux density.

(g) Determine the energy of the lowest two levels for an electron in a square well of width 3 Å.

(h) A particular sample of Ge has a donor density of $N_d = 10^{14} atoms/cm^3$. Assuming all the donor atoms to be ionized, calculate the conductivity of the sample. Given electron mobility $\mu_n = 3900 cm^2/Vs$ at 300 K.

(i) A current of 50 A is established in a Cu slab (0.2 cm thick and 2 cm wide). A magnetic field of 1.5 T perpendicular to the plane of slab and to the current is applied. Find the Hall voltage across the width of the slab.

(j) What do mean by high T_c superconductors? Give two examples of high T_c superconductors

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) (i) Deduce the conditions for constructive and destructive interference due to reflected light in a thin film of thickness t and refractive index μ.

(ii) A parallel beam of light of wavelength 5890Å is incident on a glass plate (μ = 1.5) such that the angle of refraction into the plate is 60°. What should be the minimum thickness of the glass plate, which would make the plate dark in reflected light?

(b) Differentiate interference and diffraction. What is diffraction grating?

OR

3 (a) What is polarization of light? Explain double refraction.

(b) A monochromatic light of wavelength 5860 Å is incident normally on a 2 cm wide grating. The first order spectrum is produced at an angle 20° with respect to normal. Estimate the total number of lines on the grating.

UNIT – II

4 (a) Write the disadvantages of three level laser systems. Discuss the working of four level laser systems to explain overcoming of the disadvantages.

(b) A step index fibre has a core and cladding refractive index of 1.5 and 1.47 respectively. What are the values of acceptance angle and numerical aperture?

OR

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5 (a) Define Einstein's A, B coefficients of absorption and emission. Find out relation between them.

(b) What is numerical aperture? Obtain expression.

UNIT – III

6 (a) (i) Derive the Clausius-Mosotti relation $\frac{\varepsilon_r - 1}{\varepsilon_r + 2} = \frac{N\alpha_e}{3\varepsilon_0}$. Symbols have their usual meanings.

(ii) An isotropic material has a volume of $10^6 cm^3$ and the polarization of $1.0 \times 10^{-4} C/m^2$, which introduces an electric field of $10^4 N/C$. Find the dipole moment of the slab.

(b) What are the sources (or origin) of magnetic moment in a magnetic material? Derive the expression for atomic magnetic moment.

OR

7 (a) Define polarization in a dielectric. Explain qualitatively the different types of polarization. Which type of polarization is temperature dependent?

(b) (i) Differentiate between Dia, Para and Ferromagnetic materials.

(ii) A magnetic field of 800 Amp/m produces a magnetic flux of $2 \times 10^{-5} weber$ in a iron bar of cross-sectional area 0.2 cm^2. Calculate the permeability.

UNIT – IV

8 (a) What is significance wave function ψ ? Derive time dependent Schrodinger equation.

(b) (i) What is Fermi-Dirac distribution function? Using this function show that at 0K the no electron exists in energy level greater than Fermi level.

(ii) The probability that an energy level is occupied by an electron is 10%. Locate the energy level with respect to the Fermi level.

OR

9 (a) Deduce an expression for density of states.

(b) Derive an expression for effective mass of electron.

UNIT – V

10 (a) What is Hall effect? Derive an expression for Hall coefficient.

(b) Distinguished between type-I and type-II superconductors on the basis of magnetic property. Which of the two is known as hard superconductor and why?

OR

11 (a) (i) Obtain an expression for the density of holes in valence band in a p-type semiconductor.

(ii) Find the conductivity of intrinsic Ge at 300 K if the carrier density is $2.15 \times 10^{-13} / cm^3$. The electron and hole mobilities of Ge are $3900 cm^2 / Vs$ and $1900 cm^2 / Vs$ respectively.

(b) How are cooper pairs formed? Explain the BCS theory of superconductivity.

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