Code No: R201207 **R20** SET - 1

I B. Tech II Semester Regular/Supplementary Examinations, August - 2022

APPLIED PHYSICS

(Common to **EEE, ECE, EIE, ECT, CSE-AI&ML, CSE-AI, CSE-DS, CSE-AI&DS, AI&DS)**

Time: 3 hours Max. Marks: 70

Answer any five Questions one Question from Each Unit
All Questions Carry Equal Marks

Unit- I

1. a) Explain the formation of colours in thin films and hence obtain the conditions for constructive and destructive interference fringe pattern. (10M)

   b) A parallel beam of sodium light of wavelength 5890×10^{-10}m is incident on a thin glass plate of refractive index 1.5, such that the angle of refraction in the plate is 60^{o}. Calculate the smallest thickness of the plate which will make it appear dark by reflection (4M)

Or

2. a) Differentiate between Fresnel and Fraunhoffer Diffraction. Explain the Intensity for Fraunhoffer diffraction due to single slit. (10M)

   b) A slit of width 1.5mm is illuminated by a light of wavelength 500nm, and diffraction pattern is observed on a screen 2m away. Calculate the width of the central maxima. (4M)

Unit- II

3. a) Explain Einstein's coefficients and derive relation between them. (6M)

   b) Describe the construction and working of Ruby Laser with relevant diagrams. (8M)

Or

4. a) Define Numerical aperture of an optical fiber and derive an expression for it. (7M)

   b) The refractive indices of core and cladding of a optical fiber are 1.54 and 1.50 respectively. Calculate its Numerical Aperture and Acceptance angle. (7M)

Unit- III

5. a) Derive the time independent Schrodinger's wave equation for a free particle. (10M)

   b) Find the 1^{st} excited state energy of an electron confined in a box of length 0.1 nm. (4M)

Or

6. a) State and explain Bloch theorem. (4M)

   b) Give an account of Band theory of solids based on the Kronig-Penny model. Discuss the salient features of Kronig-Penny model of a crystal. (10M)

Unit- IV

7. a) Obtain an expression for internal field inside a dielectric medium with cubic symmetry when subjected to an external electric field. (10M)

   b) A parallel capacitor is made up of conductive plates of area 100 cm^2 and plate separation of 1cm. Each of the plate is charged to a potential of 100V. Calculate the capacitance of the capacitor and charge on the plates. (4M)

Or

8. a) Explain the origin of magnetic moment. Find the magnetic dipole moments due to orbital and spin motions of an electron. (10M)

   b) A magnetic material has a magnetization of 3300A/m and flux density of 0.044 wb/m^2. Calculate the magnetizing force and relative permeability of the material. (4M)

Unit- V

9. a) Derive an expression for the concentration of holes in the valence band of a p-type Semiconductor and hence discuss the variation of its Fermi level with temperature. (10M)

   b) The Hall coefficient of silicon is found to be -7.35×10^{-5} m^3C^{-1} in the range of temperatures from 100K to 400K. Determine the nature of the semiconductor. If the conductivity was found to be 200 $m^{-1}\Omega^{-1}$, calculate the density and mobility of the charge. (4M)

Or

10. a) Explain Meissner effect in superconductors? Distinguish between type I and type II superconductors. (8M)

    b) Explain dc and ac Josephson tunneling in superconductors with relevant expressions for current density. (6M)

Code No: R201207 **R20** SET - 2

I B. Tech II Semester Regular/Supplementary Examinations, August- 2022

APPLIED PHYSICS

(Common to EEE, ECE, EIE, ECT, CSE-AI&ML, CSE-AI, CSE-DS, CSE-AI&DS, AI&DS)

Time: 3 hours Max. Marks: 70

Answer any five Questions one Question from Each Unit
All Questions Carry Equal Marks

Unit- I

1. a) Obtain the expressions for diameters of dark and bright rings in Newton's rings experiment and hence obtain the expression for wavelength of light used. (10M)

   b) Calculate the thickness of the thinnest film (μ=1.4) in which interference of violet component (λ=4000AU) of incident light can take place by reflection. (4M)

Or

2. a) What are Quarter and Half wave plates? Discuss the construction of Nicol prism. (10M)

   b) Calculate the thickness of a half wave plate of quartz for a wavelength 500nm. [Given that μ_e = 1.553 and μ_o = 1.544]. (4M)

Unit- II

3. a) Explain the purpose of an active medium and cavity Resonator in a laser. (6M)

   b) With the help of suitable diagram, explain the principle, construction and working of a He-Ne laser. (8M)

Or

4. a) Explain the principle of Optical fiber. Describe different types of fibers by giving the refractive index profiles and propagation details. (10M)

   b) The numerical aperture of an optical fiber is 0.39. If the difference in refractive index of the material of its core and cladding is 0.05, calculate the refractive index of material of the core. (4M)

Unit- III

5. a) Explain the de Broglie hypothesis. (4M)

   b) Derive time independent Schrodinger wave equation for a free particle. (10M)

Or

6. a) What is Fermi level? Explain the Fermi-Dirac distribution function of electrons. Explain the effect of temperature on the distribution function. (9M)

   b) Explain the concept of effective mass of an electron. (5M)

Unit- IV

7. a) Explain the electronic polarisability in atoms and obtain an expression for electronic polarisability in terms of the radius of the atom. (7M)

   b) The dielectric constant of He gas at NTP is 1.0000684. Calculate the electronic polarisability of He atoms if the gas contains $2.7x10^{25}$ atoms per m^3. (7M)

Or

8. a) Define Magnetic Susceptibility and Permeability. Obtain the relation between them. (6M)

   b) Explain the origin of magnetic moment. Find the magnetic dipole moments due to orbital and spin motions of an electron. (8M)

Unit- V

9. a) Derive an expression for the concentration of electrons in the conduction band of an n-type semiconductor and hence discuss the variation of its Fermi level with temperature. (10M)

   b) The Hall coefficient of silicon is found to be $-7.35x10^{-5}$ m^3C^{-1} in the range of temperatures from 100K to 400K. Determine the nature of the semiconductor. If the conductivity was found to be 200 $m^{-1}\Omega^{-1}$, calculate the density and mobility of the charge (4M)

Or

10. a) What is Meissner effect? Show that superconductors exhibit perfect diamagnetism. (7M)

    b) Describe Josephson effects. Explain the applications of Josephson effect. (7M)

Code No: R201207 **R20** SET - 3

I B. Tech II Semester Regular/ Supplementary Examinations, August- 2022

APPLIED PHYSICS

(Common to **EEE, ECE, EIE, ECT, CSE-AI&ML, CSE-AI, CSE-DS, CSE-AI&DS, AI&DS)**

Time: 3 hours Max. Marks: 70

Answer any five Questions one Question from Each Unit
All Questions Carry Equal Marks

Unit- I

1. a) Obtain an expression for the radii of n^{th} bright and dark rings in case of Newton's rings and deduce an expression for the determination of wavelength 'λ' of light from it. (10M)

   b) A parallel beam of light (λ=5890AU) is incident on a glass plate with μ=1.5 such that angle of refraction into plate is 60^0.Calculate the smallest thickness of the plate which will make it appear dark by reflection. (4M)

Or

2. a) Prove that the intensities of secondary maxima formed for Fraunhofer diffraction due to single slit decrease with increasing order. (10M)

   b) Compute the minimum number of lines required in a grating to resolve the sodium doublet (λ_1=5890 AU and λ_2=5896 AU) for the case of second order spectrum. (4M)

Unit- II

3. a) Write notes on Pumping, Population inversion and lasing action. (6M)

   b) With neat diagram, describe the construction and working of Ruby laser. (8M)

Or

4. a) Explain the principle behind the functioning of optical fiber. Derive expression for acceptance angle for an optical fiber. (10M)

   b) What are the advantages of optical fiber communication system? (4M)

Unit- III

5. a) What are the drawbacks of classical free electron theory of metals? Explain Fermi–Dirac distribution function and also its variation with temperature. (10M)

   b) Find the relaxation time of conduction electrons in a metal of resistivity $1.54x10^8$ ohm- m. If the metal has $5.8x10^{28}$ conduction electrons m^{-3}. (4M)

Or

6. a) State and explain Bloch theorem. (4M)

   b) Give an account of Band theory of solids based on the Kronig-Penny model. Discuss the salient features of Kronig-Penny model of a crystal. (10M)

Unit- IV

7. a) Explain the various polarization mechanisms in dielectric materials. (6M)

   b) Deduce the expression for Lorentz field relating to a dielectric material. (8M)

Or

8. a) Distinguish between Dia, Para and Ferromagnetism. (7M)

   b) Explain the hysteresis loop observed in ferromagnetic materials. What are hysteresis losses? (7M)

Unit- V

9. a) Explain Hall effect. Derive the expression for Hall coefficient of n-type semiconductor. (9M)

   b) Explain the applications of Hall effect. (5M)

Or

10. a) Explain the critical parameters and their significance in superconductivity. (5M)

    b) Explain Meissner effect. How is it used to classify the super conductors. (5M)

    c) Write the applications of superconductors. (4M)

Code No: R201207 **R20** SET - 4

I B. Tech II Semester Regular/Supplementary Examinations, August- 2022

APPLIED PHYSICS

(Common to EEE, ECE, EIE, ECT, CSE-AI&ML, CSE-AI, CSE-DS, CSE-AI&DS, AI&DS)

Time: 3 hours Max. Marks: 70

Answer any five Questions one Question from Each Unit
All Questions Carry Equal Marks

Unit- I

1. a) Differentiate between Fresnel and Fraunhoffer Diffraction. Explain the Intensity for Fraunhoffer diffraction due to single slit. (10M)

   b) A slit of width 1.5mm is illuminated by a light of wavelength 500nm, and diffraction pattern is observed on a screen 2m away. Calculate the width of the central maxima. (4M)

Or

2. a) What are Quarter and Half wave plates? Discuss the construction of Nicol prism. (10M)

   b) Calculate the thickness of a half wave plate of quartz for a wavelength 500nm. [Given that $\mu_e = 1.553$ and $\mu_o = 1.544$] (4M)

Unit- II

3. a) What is laser? What are the important characteristics of lasers? (5M)

   b) Derive the expression for energy density of radiation in terms of Einstein coefficients. What are the industrial applications of lasers? (7+2M)

Or

4. a) Explain the principle behind the functioning of optical fiber. What is meant by Intermodal dispersion in optical fibers? How to overcome this problem? Explain. (10M)

   b) What are the advantages of optical fiber communication system? (4M)

Unit- III

5. a) Derive the time independent Schrodinger's wave equation for a free particle. (10M)

   b) Find the 1^{st} excited state energy of an electron confined in a box of length 0.1 nm. (4M)

Or

6. a) Discuss the case of Kronig-Penny model for the motion of electrons in periodic potential. (7M)

   b) On the basis of band theory, explain how solids can be distinguished as metals, semiconductors and insulators. (7M)

Unit- IV

7. a) Explain the electronic polarisability in atoms and obtain an expression for Electronic polarisability in terms of the radius of the atom. (8M)

   b) Derive Clausius-Mosotti equation. (6M)

Or

8. a) Explain the origin of magnetism in materials. (4M)

   b) Draw and explain B-H curve for a ferromagnetic material placed in a magnetic field. Distinguish between soft and hard magnetic materials. (10M)

Unit- V

9. a) Derive an expression for the number of electrons per unit volume in the conduction band of an N-type semiconductor. (8M)

   b) Explain the effect of temperature and dopant on Fermi level in N-type semiconductor. (6M)

Or

10. a) Describe the BCS theory of superconductivity. (7M)

    b) Write notes on High T_c Superconductors. (7M)