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

I B. Tech II Semester Regular/Supplementary Examinations, July/August-2023

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

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UNIT-I

1. a) Explain the formation of Newton's rings in reflected monochromatic light. Prove that in reflected light, diameters of the dark rings are proportional to the square root of natural numbers. [10M]

   b) In Newton's rings experiment, the diameter of 4th and 12th dark rings are 0.4 and 0.7 cm, respectively. Find the diameter of 20th dark ring. [4M]

(OR)

2. a) Discuss various methods by which polarized light can be produced. [7M]

   b) What are Quarter and Half wave plates? Derive the expressions for thickness of quarter and half wave plates. [7M]

UNIT-II

3. a) What are Einstein coefficients? Derive the relation between Einstein coefficients? [10M]

   b) Explain the characteristic properties of Laser. [4M]

(OR)

4. a) What is an 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 fractional index of material of its core and cladding is 0.05, calculate the refractive index of the material of the core. [4M]

UNIT-III

5. a) Explain the de Broglie hypothesis. [4M]

   b) Derive time dependent Schrodinger wave equation for a free particle. [10M]

(OR)

6. a) Explain Fermi–Dirac distribution function and its variation with temperature. [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 various polarization mechanisms in dielectric materials. [6M]

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

(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) What is Hall effect? Derive an expression for the practical formula for the hall coefficient [10M]

   b) The R_H of a specimen is 3.66×10^{-4} m^3 c^{-1}. Its resistivity is $8.93 \times 10^{-3} \Omega m$. Find mobility and charge carrier concentration. [4M]

(OR)

10. a) What are super conductors? Explain BCS theory. [8M]

    b) Explain Meissner effect. Distinguish between type I and type II superconductors. [6M]

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

I B. Tech II Semester Regular/Supplementary Examinations, July/August-2023
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

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UNIT-I

1. a) Explain the phenomena of interference. What are the conditions to get the sustained interference of light? [5M]
   b) With ray diagram discuss the theory of thin films and derive the condition for constructive and destructive interference in the case of reflected system. [9M]

(OR)

2. a) What is meant by Double Refraction? Discuss the construction and action of Nicol prism. [10M]
   b) Find the minimum thickness of half and quarter wave plates for a light beam,λ=589.3nm if μ_e= 1.4864 and μ_o= 1.6583. [4M]

UNIT-II

3. a) Distinguish between Spontaneous and Stimulated emissions. [4M]
   b) Describe the construction and working of He-Ne laser with the help of energy level diagram. [10M]

(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) Derive the time independent Schrodinger's wave equation for a free particle. [10M]
   b) Find the second excited state energy of an electron confined in a box of length 0.1 nm. [4M]

(OR)

6. a) Derive the expression of electrical conductivity according to the quantum free electron theory. [7M]
   b) Explain the Fermi-Dirac distribution function of electrons. Illustrate graphically the effect of temperature on the distribution. [7M]

UNIT-IV

7. a) Explain the electronic polarizability in atoms and obtain an expression for electronic polarizability in terms of the radius of the atom. [8M]
   b) Derive Clausius-Mosotti equation. [6M]

(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) What do you understand by drift and diffusion currents in the case of a semiconductor? Deduce Einstein's relation relating to these currents. [10M]
   b) Explain the applications of Hall effect. [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]

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

I B. Tech II Semester Regular/Supplementary Examinations, July/August-2023
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

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UNIT-I

1. a) Account for the circular shape of 'Newton's rings' in interference pattern. Obtain an expression for the diameter of the n^{th} dark ring in the case of Newton's rings. [10M]
   b) The diameter of 9th dark ring in newton's rings experiment is 0.28 cm. What is the diameter of 16th dark ring if the wavelength of light is 6000A°. [4M]

(OR)

2. a) Show that when light is incident on a transparent material at the polarising angle, the reflected and refracted rays are at right angles. [5M]
   b) Obtain the conditions for central maximum, secondary maxima and minima in the case of Fraunhofer diffraction due to single slit. [9M]

UNIT-II

3. a) Explain the Absorption, Spontaneous emission and Stimulated emission processes with neat diagrams. [6M]
   b) What are Einstein's coefficients and derive the relation between them. [8M]

(OR)

4. a) Explain the terms Acceptance angle and Numerical Aperture and derive expressions for Acceptance angle and Numerical Aperture of an Optical fiber. [10M]
   b) Calculate the Numerical Aperture and Acceptance angle for an optical fiber with 1.48 and 1.45 as Refractive indices of core and cladding respectively. [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 1.54×10^{8} ohm- m. If the metal has 5.8×10^{28} conduction electrons m^{-3}. [4M]

(OR)

6. a) Discuss the origin of energy bands in solids. [7M]
   b) Explain how the crystalline solids are classified into metals, semiconductors and insulators on the basis of band theory. [7M]

UNIT-IV

7. a) What is meant by polarization in dielectrics? Derive the relation between dielectric constant and atomic polarizability. [7M]
   b) Obtain an expression for electronic polarizability in terms of radius of the atoms. [7M]

(OR)

8. a) Distinguish between Dia, Para and Ferromagnetisms. [7M]
   b) Explain the hysteresis loop observed in ferromagnetic materials. What are hysteresis losses? [7M]

UNIT-V

9. a) Distinguish between intrinsic and extrinsic semiconductors with suitable examples. [4M]
   b) Derive an expression for the density of holes in the valence band of an intrinsic semiconductor. [10M]

(OR)

10. a) Explain Meissner effect in superconductors. Explain dc and ac Josephson tunneling in superconductors with relevant expressions for current density. [10M]
    b) Calculate the critical current for a superconducting material wire with a diameter of 1mm at 4.2K. The critical temperature for that metal is 7.18K and critical magnetic field is 6.5×10^{4} amp m^{-1}. [4M]

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

I B. Tech II Semester Regular/Supplementary Examinations, July-2023
APPLIED PHYSICS

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Time: 3 hours Max. Marks: 70

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

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UNIT-I

1. a) Discuss the phenomena of interference of light due to thin films and find the conditions of maxima and minima. [10M]
   b) A parallel beam of light from a wavelength of 5890Å incident on a thin glass plate with refractive index 1.5, the angle of refraction is 60°. Calculate the smallest thickness of the glass plate which will appear dark in reflection geometry. [4M]

(OR)

2. a) What are the types of diffractions and give the differences between them? [4M]
   b) Obtain the conditions for central maximum, secondary maxima and minima in the case of Fraunhofer diffraction due to single slit. [10M]

UNIT-II

3. a) What are the characteristic properties of LASER? [4M]
   b) With neat diagrams, describe the construction and working of He-Ne laser. [10M]

(OR)

4. a) Explain the construction of an optical fiber. Write notes on Step Index and Graded Index fibers. [10M]
   b) The refractive indices of core and cladding of a fiber are 1.50 and 1.45 respectively. Calculate its Numerical Aperture and Acceptance angle. [4M]

UNIT-III

5. a) Derive the time independent Schrodinger's wave equation for a free particle. [10M]
   b) Explain the physical significance of wave function through ortho normalization condition. [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) Discuss in detail the electronic, ionic and orientation polarizations and their dependence on temperature. [6M]
   b) Deduce an expression for Lorentz field relating to a dielectric material. [8M]

(OR)

8. a) Discuss on the origin of magnetism in materials. Explain in detail the classification of magnetic materials. [10M]
   b) A circular loop of copper having a diameter of 10cm carries a current of 500 mA. Calculate the magnetic moment associated with the loop. [4M]

UNIT-V

9. a) What are intrinsic semiconductors? Derive an expression for electron concentration in the conduction band in an intrinsic semiconductor. [9M]
   b) Show that Fermi energy level lies in the middle of the energy gap in an intrinsic semiconductor. [5M]

(OR)

10. a) Describe the BCS theory of superconductivity. [7M]
    b) What is Meissner effect? Show that superconductors exhibit perfect diamagnetism. [7M]

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