

ENGINEERING PHYSICS

(Common to ECE, EEE, EIE, Bio-Tech, EComE, Agri.E)

Time: 3 hours

Max. Marks: 70

Question Paper Consists of **Part-A** and **Part-B**
Answering the question in **Part-A** is Compulsory,
Three Questions should be answered from **Part-B**

PART-A

- 1.(i) What are the necessary conditions for obtaining interference fringes?
- (ii) Explain the characteristic of laser.
- (iii) What are polar and non-polar dielectrics?
- (iv) Explain the terms 'Reverberation' and 'Reverberation time'.
- (v) Explain the salient features of Classical free electron theory?
- (vi) Explain the electronic transport mechanism for Photo Conductors.

[3+4+4+3+4+4]

PART-B

- 2.(a) What is meant by Diffraction of light? Explain it on the basis of Huygen's wave theory.
 - (b) Derive expressions for Acceptance angle and Numerical Aperture of an Optical fiber.
 - (c) Distinguish between soft and hard magnetic materials.
- [4+8+4]
- 3.(a) Explain in detail the principle of Optical fiber.
 - (b) Explain with necessary theory, the Fraunhofer diffraction due to 'n' slits.
 - (c) Find the relaxation time of conduction electrons in a metal of resistivity $1.54 \times 10^{-8} \Omega\text{-m}$, if the metal has 5.8×10^{28} conduction electrons per m^3 .
- [4+8+4]
- 4.(a) Derive the relation between the Einstein coefficients.
 - (b) Derive an expression for the electrical conductivity of a material in terms of mobility of the electron using classical free electron theory.
- [8+8]
- 5.(a) Explain the origin of magnetism in materials.
 - (b) Derive Sabine's formula for 'Reverberation time'.
- [4+12]
- 6.(a) Derive time dependent Schrodinger wave equation.
 - (b) Draw and explain B-H curve for a ferromagnetic material placed in a magnetic field.
- [8+8]
- 7.(a) State and explain Hall effect.
 - (b) Identify whether unit cells of SC, BCC and FCC lattices are primitive or not. Explain with reason.
 - (c) Write the difference between Spontaneous and Stimulated Emissions.

[6+6+4]



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PART-A

- 1.(i) What are the necessary conditions for obtaining interference fringes?
 - (ii) What is meant by Intermodal dispersion in optical fibers? How to overcome this problem? Explain.
 - (iii) What are polar and non-polar dielectrics?
 - (iv) What are the fundamental laws of electromagnetism?
 - (v) Explain the salient features of Classical free electron theory?
 - (vi) Write notes on Direct and Indirect band gap semiconductors.
- [3+4+4+3+4+4]

PART-B

- 2.(a) What is meant by Diffraction of light? Explain it on the basis of Huygen's wave theory.
 - (b) Explain the working of Ruby laser with the help of neat energy level diagram.
 - (c) Draw the crystal planes having Miller indices (110) and (211).
- [5+8+3]
- 3.(a) Explain the origin of energy bands in solids.
 - (b) Derive expression for interplanar spacing between two adjacent planes of Miller indices (h, k, l) and lattice constant 'a'.
 - (c) Calculate the maximum number of orders possible for a plane diffraction grating
- [6+6+4]
- 4.(a) Discuss in detail the electronic, ionic and orientational polarizations and their dependence on temperature.
 - (b) Explain Meissner effect. Describe soft and hard superconductors.
- [8+8]
- 5.(a) Distinguish between conductors, semiconductors and insulators.
 - (b) Derive Sabine's formula for 'Reverberation time'.
- [4+12]
- 6.(a) Derive expression for Hall coefficient.
 - (b) Derive an expression for the effective mass of an electron moving in energy bands of a solid. Show how it varies with the wave vector.
 - (c) Define the terms 'Reverberation' and 'Reverberation time'.
- [6+6+4]
- 7.(a) Write notes on Direct and Indirect band gap semiconductors.
 - (b) Deduce an expression for Lorentz field relating to a dielectric material.
 - (c) The R_H of a specimen is $3.66 \times 10^{-4} \text{ m}^3 \text{ c}^{-1}$. Its resistivity is $8.93 \times 10^{-3} \Omega \text{m}$. Find mobility and charge carrier concentration.
- [4+8+4]



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PART-A

- 1.(i) Distinguish between Interference and Diffraction.
- (ii) Explain the characteristic properties of laser.
- (iii) The penetration depths for Lead at 3K and 7.1K are 39.6nm and 173nm respectively. Calculate the critical temperature for Lead.
- (iv) Explain the terms 'Reverberation' and 'Reverberation time'.
- (v) Explain the concept of hole.
- (vi) Explain the electronic transport mechanism for Photo Conductors.

[3+4+4+3+4+4]

PART-B

- 2.(a) Derive expressions for Acceptance angle and Numerical Aperture of an Optical fiber.
 - (b) State Brewster's law. How can this law be used to produce plane polarized light?
 - (c) Explain in detail the flux quantization in a Superconducting ring.
- [8+4+4]
- 3.(a) Explain the principle of Optical fiber.
 - (b) Explain the principle, construction and working of a Nicol prism with neat diagram.
 - (c) What is meant by Intermodal dispersion in optical fibers? How to overcome this problem? Explain.
- [4+8+4]
- 4.(a) Discuss in detail the electronic, ionic and orientational polarizations and their dependence on temperature.
 - (b) Derive the expression for condition of maxima and minima for reflected light in case of thin transparent film of uniform thickness.
- [8+8]
- 5.(a) State and explain Stoke's theorem in its calculus form.
 - (b) Calculate the thickness of half wave plate of quartz for a wavelength 500nm. [Given that $\mu_e = 1.553$ and $\mu_o = 1.544$]
 - (c) Write a short notes on Rayleigh's Criterion.
- [6+4+6]
- 6.(a) Explain the salient features of Classical free electron theory.
 - (b) Explain with necessary theory, the Fraunhofer diffraction due to 'n' slits.
 - (c) Find the relaxation time of conduction electrons in a metal of resistivity $1.54 \times 10^{-8} \Omega\text{-m}$, if the metal has 5.8×10^{28} conduction electrons per m^3 .
- [4+8+4]
- 7.(a) What do you understand by drift and diffusion currents in the case of a semiconductor? Deduce Einstein's relation relating to these currents.
 - (b) Derive Eigen values and Eigen functions for a particle in a one dimensional potential box.
- [8+8]



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- (ii) What is meant by Intermodal dispersion in optical fibers? How to overcome this problem? Explain.
- (iii) The penetration depths for Lead at 3K and 7.1K are 39.6nm and 173nm respectively. Calculate the critical temperature for Lead.
- (iv) What are the fundamental laws of electromagnetism?
- (v) Explain the concept of hole.
- (vi) Write notes on Direct and Indirect band gap semiconductors.

[3+4+4+3+4+4]

PART-B

- 2.(a) Derive expression for interplanar spacing between two adjacent planes of Miller indices (h, k, l) and lattice constant 'a'.
 - (b) State Brewster's law. How can this law be used to produce plane polarized light?
 - (c) Explain in detail the flux quantization in a Superconducting ring.
- [8+4+4]
- 3.(a) Identify whether unit cells of SC, BCC and FCC lattices are primitive or not. Explain with reason.
 - (b) Derive an expression for wavelength of light in Newton's rings experiment.
 - (c) Distinguish between soft and hard magnetic materials.
- [4+8+4]
- 4.(a) Explain the origin of magnetism in materials.
 - (b) Explain the principle, construction and working of a Nicol prism with neat diagram.
 - (c) Draw the crystal planes having Miller indices (110) and (211).
- [4+8+4]
- 5.(a) State and explain Stoke's theorem in its calculus form.
 - (b) The R_H of a specimen is $3.66 \times 10^{-4} \text{ m}^3 \text{ c}^{-1}$. Its resistivity is $8.93 \times 10^{-3} \Omega \text{m}$. Find mobility and charge carrier concentration.
 - (c) Derive an expression for the effective mass of an electron moving in energy bands of a solid. Show how it varies with the wave vector.
- [6+4+6]
- 6.(a) Explain the origin of energy bands in solids.
 - (b) Write notes on Rayleigh's Criterion.
 - (c) Derive expression for Hall coefficient.
- [6+6+4]
- 7.(a) State and explain Hall effect.
 - (b) Draw and explain B-H curve for a ferromagnetic material placed in a magnetic field.
 - (c) Calculate the thickness of half wave plate of quartz for a wavelength 500nm. [Given that $\mu_e = 1.553$ and $\mu_o = 1.544$]

[6+6+4]

