

I B. Tech II Semester Regular Examinations August - 2014

ENGINEERING PHYSICS

(Common to CE, ME, CSE, PCE, IT, Chem E, Aero E, Auto E, Min E, Pet E, Metal 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) Write a note on colours of thin films.
- (ii) Describe the FCC sub lattice and calculate its atomic packing factor.
- (iii) Discuss the temperature dependence of magnetic susceptibility in dia, para and ferromagnetic materials.
- (iv) How will you measure absorption coefficient of a material?
- (v) What are matter waves? Derive the expression for de Broglie's wavelength.
- (vi) What are direct and indirect band gap semiconductors?

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

PART-B

- 2.(a) State and explain Brewster's law.
 - (b) Define Drift & Diffusion currents and derive Einstein's equation.
 - (c) For copper density $d = 8.92 \times 10^{-8} \text{ Kg/m}^3$, resistivity $\rho = 1.73 \times 10^{-8} \Omega\text{-m}$, atomic weight $M = 63.5$. Calculate the mobility of the electrons in copper, obeying classical laws.
- [4+8+4]
- 3.(a) What is population inversion and how can it be achieved?
 - (b) Explain the Principle, construction and working of a Nicol prism with neat diagram.
 - (c) Draw the diagram to show the variation of the Fermi level with temperature and impurity concentration in case of n-type semiconductor.
- [4+8+4]
- 4.(a) Differentiate between soft and hard superconductors.
 - (b) Explain the three level and four level laser systems. What are the advantages of four level laser system over three level laser system?
 - (c) In Newton's rings experiment, diameter of the tenth dark ring due to wavelength 6000 \AA in air is 0.5 cm. Find the radius of curvature of the lens.
- [4+8+4]
- 5.(a) Explain the polarization mechanism in dielectrics.
 - (b) Explain BCS theory with key note of cooper pairs.
 - (c) State few applications of laser.
- [4+8+4]
- 6.(a) What are the draw backs of classical free electron theory?
 - (b) What are the polar and non-polar dielectrics? Derive Clausius-Mosotti equation.
 - (c) Mention the applications of Josephson's effect.
- [4+8+4]
- 7.(a) Distinguish between n-type and p-type semiconductors.
 - (b) Derive an expression for electrical conductivity of a conducting material based on quantum mechanical treatment.
 - (c) The penetration depths for lead at 3 K and 7.1 K are 39.6nm and 173nm respectively. Calculate the critical temperature for lead.
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PART-A

- 1.(i) What are Newton's rings? Why are they circular?
 - (ii) Describe the BCC sub lattice and calculate its atomic packing factor.
 - (iii) Define magnetic susceptibility. Why is it negative for diamagnetic materials?
 - (iv) What are the necessary conditions of physically acceptable wave function?
 - (v) Write the Maxwell's electromagnetic equations in differential or integral form.
 - (vi) How does the Fermi level change with temperature in extrinsic semiconductors?
- [4+4+3+3+4+4]

PART-B

- 2.(a) Distinguish between Fresnel and Fraunhofer diffractions.
 - (b) Define Drift & Diffusion currents and derive the expressions for drift and diffusion current densities.
 - (c) Find the relaxation time of conduction electrons in a metal if its resistivity is $1.54 \times 10^{-8} \Omega \text{m}$ and it has 5.8×10^{28} conduction electrons per cubic metre.
- [4+8+4]
- 3.(a) Explain Step Index and Graded index optical fibers.
 - (b) Give the theory of plane diffraction grating. Obtain the condition for the formation of n^{th} order maximum.
 - (c) In a Hall coefficient experiment, a current of 0.25A is sent through a metal strip having thickness 0.2mm and width 5mm. The Hall voltage is found to be 0.15mV when a magnetic field of 2000 gauss is used. What is the carrier concentration?
- [4+8+4]
- 4.(a) Derive the relation between polarization vector \vec{P} , the electric field \vec{E} and displacement vector \vec{D} .
 - (b) Derive an expression for acceptance angle of fiber in terms of the refractive indices of core and cladding of an optical fiber. What is meant by acceptance cone?
 - (c) Distinguish between the spectra formed by a prism and a grating.
- [4+8+4]
- 5.(a) How matter waves are different from Electromagnetic waves?
 - (b) Explain the electronic polarisability and show that electronic polarisability for a monochromatic gas increases as the size of the atoms becomes larger.
 - (c) Find the numerical aperture and acceptance angle of a fiber of core index 1.4 and fractional index change 0.02.
- [4+8+4]
- 6.(a) What are the basic assumptions of classical free electron theory?
 - (b) Derive the time dependent Schrodinger wave equation.
 - (c) Explain the terms 'Dielectric breakdown' and 'Dielectric strength'.
- [4+8+4]
- 7.(a) State and explain Hall effect.
 - (b) Derive the expression for the density of energy states and carrier concentration in a metal.
 - (c) Calculate the de Broglie wavelength of an electron moving with velocity 10^7m/s .
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