

FE Sem-I (C-scheme) June 2026

Time: 2 Hours

Total Marks: 60

N.B.:

- (1) Question No. 1 is compulsory.
- (2) Attempt any three questions from Q. 2 to Q. 6
- (3) Assume suitable data wherever required.
- (4) Figures to the right indicate marks.

Q. 1 Attempt any five

[15]

- a) Define Superconductivity, Critical Temperature and Critical Magnetic Field
- b) Draw the following with reference to cubic unit cell (002); (101); (111)
- c) Explain Construction of LCD
- d) State de Broglie's hypothesis. Deduce an expression for the wavelength of de Broglie's matter waves
- e) What are the properties of matter waves?
- f) What is the significance of wave function?
- g) The resistivity of Cu is 1.72×10^{-8} ohm-m. calculate the mobility of electron in Cu. Given that the number of electrons per unit volume is $10.41 \times 10^{28}/m^3$

Q. 2

- a) Derive the condition for maxima and minima due to interference of light in wedge shaped film. [7]
- b) Explain the concept of Fermi level in an Extrinsic Semiconductor.
A Cu strip 2 cm wide and 1 mm thick is placed in a magnetic field of 1.5 Wb/m^2 . If a current of 200 A is set up in the strip, calculate the Hall voltage that appears across the strip. (Given: $R_H = 6 \times 10^{-7} \text{ m}^3/\text{C}$) [8]

Q. 3

- a) Explain phase velocity & group velocity of a matter waves. Derive the one dimensional time dependent Schrodinger wave equation for matter waves. [8]
- b) What is photovoltaic effect? Explain the principle, working & applications of solar cell. [7]

Q. 4

- a) Explain Heisenberg's uncertainty principle with example & give its physical significance [5]
- b) In Newton's ring experiment the diameter of 4th and 12th dark rings are 0.40cm and 0.70cm. find the diameter of 20th dark ring in reflected light. [5]
- c) Calculate electron and hole concentration in intrinsic silicon at room temperature if its electrical conductivity is $4 \times 10^{-4} \text{ mho/m}$. (mobility of electron = $0.14 \text{ m}^2/\text{V-s}$ & mobility of hole = $0.04 \text{ m}^2/\text{V-s}$) [5]

Q. 5

- a) What are Type I and Type II superconductors [5]
- b) Find the energy of neutron in electron volt(ev) whose de Broglie wavelength is $1 \text{ \AA}$. Mass of Neutron = 1.674×10^{-27} , Planck's constant (h) = $6.62 \times 10^{-34} \text{ J-s}$. [5]
- c) Derive an expression for the interplanar spacing for (hkl) planes in a cubic crystal. [5]

Q. 6

- a) What are liquid crystals? Explain various phases of liquid crystals. [5]
- b) Define and explain anti-reflection films. [5]
- c) State and explain Meissner effect? [5]
