

FE Sem. I (C Scheme) Engg. Nov. 2025

1/1

[2 Hours]

[Total Marks: 60]

Date 13/11/2025

Q.P. Code. 95305

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) Draw the following planes (101), (121), (113)
- b) In Newton's Rings reflected light of wavelength  $5 \times 10^{-3}$  cm. The diameter of the 10<sup>th</sup> dark ring is 0.5 cm. Calculate radius of curvature R.
- c) What is de Broglie wavelength of an electron which has been accelerated from rest through a p.d. of 100 V?
- d) Explain construction of Liquid Crystal Display.
- e) Explain Meissner effect with application.
- f) What is the significance of wave function?
- g) Explain why an excessively thin film appears black in the reflected light.

Q. 2

- a) Explain the concept of holes as majority carriers in the p-type semiconductors. Calculate electron and hole concentration in intrinsic silicon at room temperature if its electrical conductivity is  $4 \times 10^{-4} (\Omega\text{-m})^{-1}$ . Take  $\mu_e = 0.14 \text{ m}^2/\text{v-s}$  and  $\mu_h = 0.04 \text{ m}^2/\text{v-s}$  [3+5]
- b) Derive the condition for maxima and minima due to interference of light-reflected from a thin film of uniform thickness. [7]

Q. 3

- a) Derive one dimensional time dependent Schrodinger equation for matter waves. [8]
- b) Explain the Principle, construction and working of LED. [7]

Q. 4

- a) Explain analysis of crystal structure using Bragg's X-ray spectrometer. [5]
- b) What are the properties of matter waves [5]
- c) Find the thickness of the soap film which appear yellow ( $\lambda = 5896 \text{ \AA}$ ) in reflection when it is illuminated by white light at an angle of  $45^\circ$ . (Given R.I. of the film is 1.33) [5]

Q. 5

- a) What are high  $T_c$  superconductors? Explain their Principle characteristics, advantages, disadvantages and applications. [5]
- b) Derive an expression for the interplanar spacing for (hkl) planes in a cubic crystal. [5]
- c) In a semiconductor with  $R_H = 145 \text{ cc/c}$  having width of 2 cm and thickness 0.2 cm with a magnetic induction of 2T along the smaller dimension, a current of 150 mA is passing. Calculate current density and Hall voltage [5]

d) Q. 6

- a) What is mesomorphic state of matter? Explain with a neat diagram the cholesteric state [5]
- b) Distinguish between type-I and type-II supercapacitors [5]
- c) White light is incident at an angle of  $45^\circ$  on a soap film  $4 \times 10^{-5}$  cm thick. Find the wavelength of light in visible spectrum which will be absent in the reflected light. ( $\mu = 1.2$ ) [5]

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