Total No. of Questions – [ 03 ]

Total No. of Printed Pages: 01

| G.R. No. | |
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Paper Code - U119 - 104 CB(T1)

**OCTOBER 2019 / INSEM (T1)**

**F. Y. B.TECH. (COMMON) (SEMESTER - I)**

**COURSE NAME: Engineering Physics (CB)**

**COURSE CODE: ES10184A-CB**

**(PATTERN 2018)**

Time: [1 Hour]

[Max. Marks: 20]

**Instructions to candidates:**

1) **All questions are compulsory.**
2) **Figures to the right indicate full marks.**
3) **Use of scientific calculator is allowed.**
4) **Use suitable data where ever required.**

Q 1) Attempt any **two**.

a) Derive an expression for condition of destructive interference by reflection from a thin uniform film which has a refractive index greater than its surrounding. **[4]**

b) With the help of neat diagrams, derive an expression for minima in Fraunhofer diffraction from a single slit using phasor diagram. **[4]**

c) Two glass plates with refractive index of 1.5 enclose a wedge shaped film of water with refractive index of 1.33. Ten fringes are observed over a length of 14mm by using light of wavelength 5890Å. Calculate the angle of the wedge in seconds. **[4]**

Q 2) Attempt any **two**.

a) If the density of states in the conduction band is given by **[4]**

$gc(E) = \frac{4}{\sqrt{\pi}}\left[\frac{m_e^*}{2\pi\hbar^2}\right]^{3/2}(E - E_c)^{1/2}$ for E ≥ Ec, derive an expression for number of electrons in the conduction band.

b) Starting from the expressions for the Fermi energy on the n and p sides of a p-n junction diode, derive and expression for built-in potential $V_{bi}$. **[4]**

c) If the probability of finding an electron 0.064 eV above the Fermi energy is 0.077, what is the temperature of the solid? **[4]**

Q 3) Attempt any **one**.

a) Assuming a joint density of states $g_J(E) = \frac{(2m_r^*)^{3/2}}{2\pi^2\hbar^3}\sqrt{E - E_g}$ and Boltzmann's distribution for carrier distribution $f(E) = \exp\left(-\frac{E}{kT}\right)$, show that the maximum in the Luminescence Intensity due to inter-band transition occurs at $E = E_g + \frac{kT}{2}$. **[4]**

b) Derive an expression for $\frac{P_{escape}}{P_{source}}$ in terms of refractive index of the material of an LED and its surrounding arising due to critical angle loss. **[4]**