FE FY B.Tech 5/3/20

Total No. of Questions – [03]

EP

Total No. of Printed Pages: 01

G.R. No.	

MARCH 2020 / INSEM (T1)

F. Y. B.TECH. (COMMON) (SEMESTER - II)

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 less 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) For a diffraction grating with 600grooves/mm, calculate the angle (in degrees) of the first minimum after the second principal maximum for wavelength of 632.8nm if the width of the grating is 15mm. **[4]**

Q 2) Attempt any **two**.

a) Show that Fermi-Dirac distribution function is symmetric about the Fermi energy E_F by proving the identity **[4]**

$$f(E_F + \Delta E) = 1 - f(E_F - \Delta E)$$

b) For a p-type semiconductor, prove that **[4]**

$$E_F = E_{Fi} - kTln\left(\frac{N_A}{n_i}\right)$$

c) Calculate the built in potential V_{bi} for a Germanium diode with a doping of 3.7×10^{16} /cm^3 on the n-side and 0.6×10^{15} /cm^3 on the p-side. The intrinsic charge carrier density at T = 300K for Germanium is 2.4×10^{13}/cm^3. **[4]**

Given, k = 1.38×10^{-23} J/K and e = 1.6×10^{-19} C.

Q 3) Attempt any **one**.

a) With the help of neat diagram(s) explain the concept of direct and indirect band gap in a semiconductor. Discuss how an iso-electronic impurity helps in transition from conduction band to valence band in an indirect band gap material due to Heisenberg's uncertainty principle. **[4]**

b) If the absorption coefficient of GaAs is 1.2×10^4 cm^{-1} at 800nm, then what is the percentage of light absorbed after it travels a distance of 1.7μm? **[4]**