Total No. of Questions – [3] Total No. of Printed Pages: 2

G.R. No.	

Paper Code- U118 - 104CB (T1)

OCTOBER 2018 / IN-SEM (T1)

F. Y. B.TECH. (CB) (SEMESTER - I)

COURSE NAME: Engineering Physics - CB

COURSE CODE: ES10184A-CB

(PATTERN 2018)

Time: [1 Hour] [Max. Marks: 20]

Instructions to candidates:

1) **Answer Q.1 OR Q.2, Q.3 OR Q.4 and Q.5**
2) **Figures to the right indicate full marks.**
3) **Use of scientific calculator is allowed**
4) **Use suitable data wherever required**

		Statement of question	Marks	Marking scheme	Cognitive	Difficulty	CO
Q1	a)	With the help of a neat diagram, derive the expression for geometrical path difference between the two rays reflected from the top and the bottom surfaces of a thin uniform film. The refractive index μ of the film is greater than that for the media on both sides of the film.	4	Diagram -1 Derivation - 3	U, C	M	1
	b)	Draw intensity as a function of angle of diffraction θ for Fraunhofer diffraction from a single slit. Discuss the significance of wavelength to slit width ratio in diffraction effect.	4	Diagram - 1 Discuss what happens when $\frac{\lambda}{a} < 1, = 1 \; and > 1$	U, C	M	1
	c)	A laser light of wavelength 6328 A.U. falls normally on a grating which is 2 cm long. The first order spectrum is observed at an	4	$M = \frac{sin\theta}{m\lambda}, N = wM$ $\therefore N = 2 \times \frac{sin20}{1 \times 6328 \times 10^{-8}}$ N=10810	A	L	1

		angle of 20°. Find the total number of slits on the grating.					
Q2	a)	Given the density of states $g_c(E) = \frac{4}{\sqrt{\pi}}\left[\frac{m_e^*}{2\pi\hbar^2}\right]^{3/2}(E-E_c)^{1/2}$, derive the expression for n, the number of electrons per unit volume in the conduction band.	4	Derivation - 4	U, C	H	2
	b)	The effective density of states for the conduction and valence bands for GaAs are N_c=4.7x10^{17} cm^{-3} and N_v=7.0x10^{18} cm^{-3}, respectively and a band gap of 1.42eV at a temperature T=300K. Calculate the intrinsic carrier density n_i.	4	$n_i = \sqrt{N_c N_v}e^{-E_g/2kT}$ $n_i = 1.81 \times 10^{18} e^{-1.42/0.0516}$ $n_i = 2.02 \times 10^6\ cm^{-3}$	A	M	2
	c)	Draw the Fermi-Dirac distribution function for temperatures T = 0 K, T1 and T2 where T2 > T1 > 0 K. Discuss the physical significance of the temperature dependence of Fermi-Dirac distribution function.	4	Drawing the diagram using the formula - 2M Discussion - 2M	U, C	L	2
Q3	a)	Discuss critical angle loss in a planar LED by deriving the expression for $\frac{P_{escape}}{P_{source}}$.	4	Diagrams for explaining the concept and derivation- 1M Derivation and discussion - 3M	U, C	M	3
	b)	Draw the I-V characteristics of a solar cell and discuss the significance of open circuit voltage, short circuit current and Fill Factor.	4	Diagram - 1M Discussion - 3M	U, C	M	3