Maulana Azad National Institute of Technology, Bhopal
End Term Examination, February 2023
B.Tech. I Sem. (Session 2022-23)
Sections: A, B, C, D, E

Subject: Physics Subject code: PHY 102

Time: 3 hr. Max. Marks: 60

Note: answer all questions

Q. No.	Questions	Marks
1.	(a) Discuss the phenomenon of interference in thin film of uniform thickness. Obtain the conditions for maxima and minima	6
	(b) In Newton's ring arrangement a source emitting two wavelengths $\lambda_1 = 6.0 \times 10^{-7}$ m and $\lambda_2 = 5.9 \times 10^{-7}$ m. It is found that n^{th} dark ring due to one wavelength coincides with $(n+1)^{th}$ dark ring due to the other. Find the diameter of the n^{th} dark ring if radius of curvature of the lens is 0.9 m.	6
2.	(a) What is Fermi Level? Prove that in intrinsic semiconductor Fermi level lies in the middle of forbidden band.	6
	(b) An electric field of 100 V/m is applied to a sample of n-type semiconductor whose Hall coefficient is -0.0125 m^3/C. Determine the current density in the sample assuming $\mu_e = 0.36\ m^2/Vs$.	6
3.	(a) Describe the principle and working of Betatron? Derive the Betatron condition for successful acceleration of electrons.	6
	(b) The wave function of a certain particle is $\psi = A\cos^2 x$ for $-\frac{\pi}{2} < x < \frac{\pi}{2}$. Then find (i) The value of A. (ii) The probability that a particle be found between $x = 0$ and $x = \frac{\pi}{4}$	6
4.	(a) What are Einstein's coefficients? Derive relation between Einstein's A and B coefficients.	6
	(b) How light propagates through an optical fibre? Derive expression for acceptance angle and numerical aperture.	6
5.	(a) State and derive Bethe's Law. How is it analogous to Snell's law?	3
	(b) Describe with the suitable expression the motion of electron in a uniform electric field, when Electric Field is perpendicular to the direction of motion of electron.	3
	(c) What do you mean by Time Dilation in special theory of relativity? Deduce the expression for it.	3

Some useful constants:-
Boltzmann Constant: $1.38 \times 10^{-23}\ m^2\ kg\ s^{-2}\ K^{-1}$
Mass of electron: 9.109×10^{-31} Kg
Speed of light: 3×10^8 m/s
Planck's Constant: 6.626×10^{-34} Joule sec