Scholar No. / Roll No.	2	4	G	0	3	1					

Maulana Azad National Institute of Technology Bhopal

Department of Physics

II Sem. Mid-Term Exam. April-2025

Semester – II (Session 2024-25) **B. Tech. (Sections: F, G, H, I & J)**

Subject Code: PHY-24102 **Subject: Physics** **Time: 1 Hr** **Max. Marks: 20** **Date: 02/04/2025**

Note: Attempt all questions

Q. No.	Questions	Marks	COs
1a.	What do you understand by missing order spectra in a transmission grating?	1	CO1
1b.	A semiconductor acts as an insulator at T = 0 K. Explain.	1	CO1
1c.	What is de-Broglie hypothesis? Estimate the de Broglie wavelength of an electron accelerated from rest through a potential difference of 100 V.	1 + 1	CO1
2a.	Derive an expression for the intensity distribution in Fraunhofer diffraction through a single slit, with a suitable diagram. Additionally, explain the conditions for the formation of maxima and minima in the diffraction pattern.	3 + 2	CO2
2b.	In Newton's rings experiment using sodium light, what is the order of the dark ring whose diameter is twice that of the 4^{th} dark ring?	2	CO3
2c.	Light is normally incident on a diffraction grating that is 0.5 cm wide and contains 2500 lines. Determine the angular separation between the two closely spaced sodium spectral lines, with wavelengths 5890 Å and 5896 Å, in the first order ($m = 1$) diffraction spectrum.	2	CO4
3a.	Write down the Fermi-Dirac (FD) distribution function and plot it for T = 0 K, and finite temperatures $T_1 > T_2 > T_3$. Define Fermi energy.	2 + 1	CO3
3b.	A Germanium (Ge) semiconductor is doped with an acceptor impurity at a concentration of 10^{15} atoms/cm^3. Given that the hole mobility is 1800 cm^2/V.s, calculate the resistivity (ρ) of the material. (Given: Charge of an electron $q = 1.6 \times 10^{-19}$ C).	2	CO4
3c.	Explain whether the functions (i) $\psi(x) = \exp(x^2)$ and (ii) $\psi(x) = \cot(x)$ are valid wave functions in quantum mechanics. Justify your answer based on the necessary conditions for an acceptable wave function.	2	CO5

End