

Maulana Azad National Institute of Technology, Bhopal

Department of Physics
End Term Examination, June 2021,
B.Tech. II Sem
Sections: F, G, H, I, J

Subject: Physics

Subject code: PHY-112

Time: 3 hrs.

Max. Marks: 50

Note: Answer all questions

| Q. No. | Questions | Marks |
|--------|--|-------|
| 1. | (a) Derive the expression for the maximum thickness of thin film up to which one can see the interference pattern? | 5 |
| | (b) Explain the missing orders in Fraunhofer diffraction through double slit and deduce the condition, if the slit widths are 0.16 mm and they are $(0.8+0.00R)$ mm apart. Where 'R' is the last two digits of your roll number. | 4 |
| 2. | (a) What do you mean by Fermi energy? Derive the expression for Fermi energy in intrinsic semiconductors. | 5 |
| | (b) An n-type germanium sample has a donor density of $(10^{20} \times \alpha) / \text{m}^3$. It is arranged in a Hall experiment having magnetic field of 0.5 T and the current density is 500 A/m^2 . Find the Hall voltage if the sample is 3 mm wide. Where multiplication factor 'α' is the last three digits of your roll number. | 4 |
| 3. | (a) Explain the phenomenon of quantum tunneling using alpha decay. | 5 |
| | (b) State and derive Bethe's Law. How is it analogous to Snell's law? | 4 |
| 4. | (a) What do you mean by G.M. Counter? Give its working in detail. What is dead time and recovery time? | 5 |
| | (b) Deuterons in a cyclotron describe a circle of radius 0.32 m just before emerging from the Dees. The frequency of the applied emf is 10 MHz. Find the flux density of the magnetic field and velocity of deuterons emerging out of the cyclotron. | 4 |
| 5. | (a) What do you mean by Einstein's A and B coefficients? Deduce the relation between them. | 5 |
| | (b) Derive an expression for numerical aperture for an optical fibre. An optical fibre has a core material of refractive index of 1.55 and cladding material of refractive index 1.51. Calculate: (a) Numerical aperture, (b) Acceptance angle. | 4 |
| | (c) What do you mean by length contraction in special theory of relativity? Deduce the expression for it. | 5 |

Some useful constants:

Mass of deuterium = $3.32 \times 10^{-27} \text{ kg}$

Charge of electron = $1.6 \times 10^{-19} \text{ C}$