

# ABV-IIITM, GWALIOR

Mid-term-test - (Sept. 2023)

Engg. Physics –B.Tech. 2023 (CSE/EEE/MS)

TIME: 2 Hrs

MM: 30

**NB: Attempt all questions. All questions carry equal marks.**

- ✓ 1. Discuss and derive Planck's radiation formula. Explain Wien's law and Rayleigh-Jeans.
- ✓ 2. Distinguish between phase velocity and group velocity. Show that for a non-relativistic free particle the phase velocity is half of the group velocity.
- ③ 3. State and explain Compton effect? Derive the expression for Compton wavelength shift.
- ✓ 4. Write down Schrödinger equation for a particle in a one-dimensional box. Solve it to obtain eigen functions and show that the eigen values are discrete.
- ✓ 5. For a particle in the states  $n=1, 2$  and  $3$  of a one-dimensional box of length  $L$ , find the probability that the particle is in the region  $0 < x < a/4$ .
6. X-rays with  $\lambda = 1 \text{ \AA}$  are scattered from a carbon block. The scattered radiation is viewed at  $90^\circ$  to the incident beam. Calculate the Compton shift  $\Delta \lambda$  and the kinetic energy imparted to the recoil electron?

$$\sin\left(\frac{\pi a}{L}\right) = \frac{2}{A^2}$$

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