

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(END SEMESTER EXAMINATION)

CLASS: IMSc  
BRANCH: MATHEMATICS AND COMPUTING

SEMESTER : III  
SESSION : MO/2025

SUBJECT: PH111 PHYSICS-II

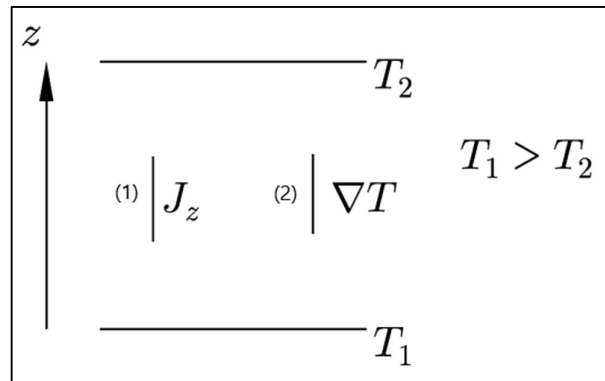
TIME: 3 Hours

FULL MARKS: 50

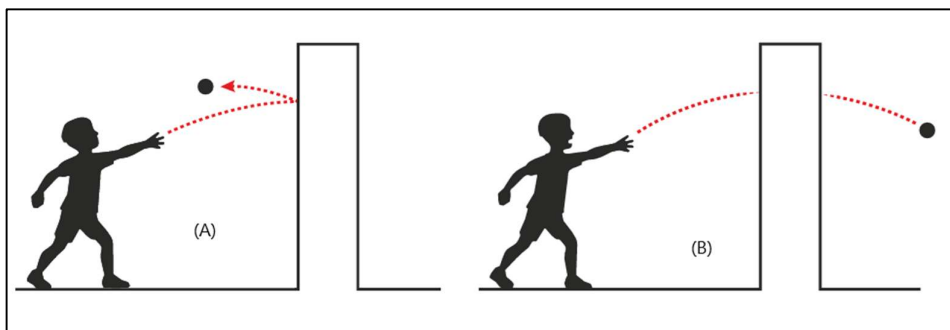
**INSTRUCTIONS:**

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
  2. Attempt all questions.
  3. The missing data, if any, may be assumed suitably.
  4. Before attempting the question paper, be sure that you have got the correct question paper.
  5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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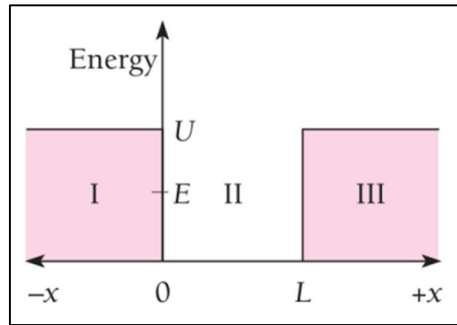
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|---|-----|----|-----|
| Q.1(a) Write the mathematical expression of Maxwell Boltzmann's speed distribution function. For this distribution, calculate the value of product of mean speed $\langle v \rangle$ and the mean inverse speed $\langle 1/v \rangle$ . Hint: Integrate in the interval $[0, \infty]$               | [5] | 1  | III |
| Q.1(b) Refer to the figure below and mark the direction in which the two lines (1) and (2) will point towards. Deduce mathematically the relationship between the heat flux vector $\vec{J}$ and temperature gradient $\nabla T$ by utilizing the fundamentals of heat conduction in one dimension. | [5] | 1  | III |



- Q.2(a) Refer to the two figures (A) and (B) and write their captions that signify the Physics associated with the figures. [5] 2 VI



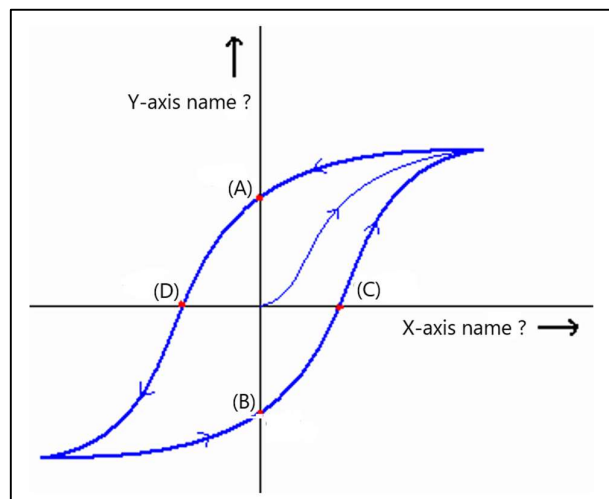
- Q.2(b) What does the following figure represent? Write the Schrodinger's steady state equation [5] 2 IV  
 related to the figure, and obtain the solution of the Schrodinger's equation in terms of  
 wave functions in the regions I, II and III.



- Q.3(a) Explain the seven factors that are essential in the lasing action. [5] 3 I  
 Q.3(b) What are the two postulates of the Einstein's with respect to absorption and emission [5] 3 II  
 and how they are associated mathematically in terms of Einstein's coefficients?  
 Q.4(a) Explain the fundamentals of microscopic and macroscopic polarization and deduce an [5] 4 II  
 expression of Clausius-Mossotti relation.  
 Q.4(b) Describe the fundamentals of frequency dependence of the dielectric constant. Refer to [5] 4 II  
 the table below and point out one major difference and state the reason regarding the  
 same.

Material	Static $\epsilon$	Optical $\epsilon$
Diamond	5.68	5.66
NaCl	6.1	2.34
LiF	11.95	2.78
TiO <sub>2</sub>	94	6.8

- Q.5(a) Name the plot as depicted below and write the axes names. Besides, what does the [5] 5 II  
 points (A), (B), (C), and (D) indicate?



- Q.5(b) Explain the principle of magnetization rotation in a ferromagnetic solid. [5] 5 II  
 :::::19/11/2025:::::E