



**DG-3119**

**Third Year B. Sc. (Sem. V) Examination**

**March/April – 2016**

**Statistical Mechanics & Relativity : Paper - IX**

Time : Hours]

[Total Marks : 50

**Instructions :**

(1)

नीचे दृष्टांतव $\leftarrow$ निशानीवाणी विगतो उत्तरवडी पर अवश्य लपवी. Fillup strictly the details of $\leftarrow$ signs on your answer book.	Seat No. :
Name of the Examination :	<input type="text"/>
$\leftarrow$ <b>Third Year B. Sc. (Sem. V)</b>	<input type="text"/>
Name of the Subject :	<input type="text"/>
$\leftarrow$ <b>STATISTICAL MECHANICS &amp; RELATIVITY : PAPER - IX</b>	<input type="text"/>
$\leftarrow$ Subject Code No. : <input type="text"/> 3 <input type="text"/> 1 <input type="text"/> 1 <input type="text"/> 9 $\leftarrow$ Section No. (1, 2,.....): <input type="text"/> Nil	<input type="text"/>
	Student's Signature

- (2) All symbols have their usual meanings.
- (3) Draw a neat diagram wherever necessary.
- (4) Figures to the right indicate full marks of the question.
- (5) Use of scientific calculator is allowed.

1 Answer the following in brief. [08]

- (1) What are the properties of hypothetical medium ether?
- (2) What are the postulates of special theory of relativity?
- (3) What is the principle of Galilean - Newtonian relativity?
- (4) What do you mean by proper time?
- (5) What do you mean by macroscopic state?
- (6) State postulate of equal a priori probability.
- (7) What do you mean by mean value over an ensemble?
- (8) What do you mean by partition function?

2 (a) What do you mean by canonical ensemble? Derive the probability distribution function for canonical ensemble. [10]

OR

2 (a) Prove that energy fluctuation in the canonical distribution is proportional to the specific heat. [10]

- 2 (b) A system with two energy levels is in equilibrium with a heat reservoir at 500K. The energy gap between the levels is 0.1 eV. Find the temperature at which the probability of the system to be in the higher energy level is 0.25. ( $k_B = 1.38 \times 10^{-23} \text{JK}^{-1}$ ) [04]
- OR
- 2 (b) Explain the principle of conservation of extension. [04]
- 3 (a) Derive the equation of Einstein's law of addition of velocity. [10]
- OR
- (a) Explain: Michelson Morley experiment. [10]
- 3 (b) The length of a spaceship is measured to be exactly half its proper length. What is the dilation of the spaceship's unit time? [04]
- OR
- 3 (b) Show that  $x^2 + y^2 + z^2 - (ct)^2$  is invariant under Lorentz transformation. [04]
- 4 Attempt **any two**: [14]
- (1) Discuss the consequences of Liouville's theorem.
- (2) Write a short note on phase space.
- (3) Prove that mass is a relative term.
- (4) Discuss: length contraction
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