# B.Sc.3529 - Mathematics-II (Optional) : (Special Relativity-I) Paper-II

P. Pages : 2          **GUG/W/16/3373**

Time : Three Hours      ‖‖‖‖‖‖‖‖ *4 3 1 2 *      Max. Marks : 60

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Notes : 1. Solve all the **five** question.
2. Question 1 to 4 has an alternative solve each question in full or its alternative in full.
3. Each question carry equal marks.

## UNIT – I

**1.** a) Prove that Maxwell's equation of electromagnetic theory do not remain invariant under Galilean transformation.    **6**

b) Define an inertial system and show that in an inertial frame, a body not under the influence of any force moves in a straight line with constant velocity.    **6**

**OR**

c) Explain the null result of Michelson Morley experiment by using Fitzerald and Lorentz contraction hypothesis.    **6**

d) Obtain Galilean transformation in relativity.    **6**

## UNIT – II

**2.** a) Discuss length contraction in special Relativity.    **6**

b) Show that Lorentz transformation from a group.    **6**

**OR**

c) Prove that $\nabla^2 - \dfrac{1}{c^2}\dfrac{\partial^2}{\partial t^2}$ is invariant under Lorentz transformation.    **6**

d) Write down the geometrical interpretation of Lorentz transformation.    **6**

## UNIT – III

**3.** a) Obtain the transformation of Lorentz contraction factor $\left(1-\dfrac{u^2}{c^2}\right)^{1/2}$.    **6**

b) Obtain the transformation equation for component of particle velocity.    **6**

**OR**

| | | |
|---|---|---|
| c) | Show that in nature no signal can move with velocity greater then velocity of light relative to any inertial system. | **6** |
| d) | Obtain the transformation equations for acceleration of a particle. | **6** |

## UNIT – IV

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| **4.** | a) | Prove that the proper time of a moving object is always less than the corresponding interval in the rest system. | **6** |
| | b) | Prove that there exists an inertial system S' in which two events occures at one and the same time if the interval between two events is spacelike. | **6** |

### OR

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|---|---|---|---|
| | c) | Derive the distance formula or metric in index form of space time geometry of special relativity. | **6** |
| | d) | Define four tensor. Write its sixteen component in matrix form and prove that $T'^{34} = \alpha \left\{ -\dfrac{v}{c} T^{31} + T^{34} \right\}$. | **6** |

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|---|---|---|---|
| **5.** | | Attempt **any six.** | |
| | a) | Define inertial system. | **2** |
| | b) | Define space and time. | **2** |
| | c) | State the postulates of special relativity. | **2** |
| | d) | Show that simultaneity is relative in special relativity. | **2** |
| | e) | Write the expressions of relativistic addition law for velocities. | **2** |
| | f) | Write the transformations for the velocities of a particle. | **2** |
| | g) | Define four tensor. | **2** |
| | h) | Define world line. | **2** |

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