B.Sc.-III (CBCS Pattern) Semester - V

USMT12 : DSE : Mathematics-IV (Special Relativity-I)

P. Pages : 2 **GUG/S/23/13118**

Time : Three Hours * 0 2 6 1 * Max. Marks : 60

Notes : 1. All the questions carry equal marks.
2. Solve all the **five** questions.

UNIT – I

1. a) Show that Newton's Kinematical equations of motion are invariant under Galilean transformations. **6**

b) According to the Fitzgerald & Lorentz contraction hypothesis show that N = 0. **6**

OR

c) Obtain the Galilean transformations. **6**

d) Show that the Maxwell's equations do not remain invariant under G.T. **6**

UNIT – II

2. a) Show that set of all Lorentz transformations forms a group. **6**

b) Show that simultaneity is relative in special relativity. **6**

OR

c) Show that $x^2 + y^2 + z^2 - c^2t^2$ is Lorentz invariant state the two postulates of special relativity. **6**

d) Explain the time dilation in briefly. **6**

UNIT – III

3. a) Obtain the transformations of the particle velocities. **6**

b) In a system S' let $u_x' = c\cos\theta$, $u_y' = c\sin\theta$ & if S' moves with velocity ν relative to S along x-axis then show that $u_x^2 + u_y^2 = c^2$ in S. **6**

OR

c) Obtain the transformations of the Lorentz contraction factor. **6**

d) A system S' moves with velocity 0.6C relative to system S along the positive direction of x-axis. Find the velocity of the particle in the system S, if the particle moves with velocity $u' = (0.4c)i + (0.3c)j + (0.2c)k$ in S'. **6**

UNIT – IV

4. a) Define the events occurring at the same point. Show that there exists an inertial system S' in which the two events occur at one & the same time if the interval between two events is space like. **6**

b) Obtain the Lorentz transformations in index form & find the partial derivatives of these transformations. **6**

OR

c) Define the four tensor & show that $T'^{12} = \alpha\left[T^{12} - \frac{v}{c}T^{42}\right]$ & hence show that for antisymmetric four tensor $T'^{12} = \alpha\left[T^{12} + \frac{v}{c}T^{24}\right]$ **6**

d) Show that the moving clocks go slow than those at rest. **6**

5. Solve **any six** questions.

a) Define the inertial system & the event. **2**

b) State the four Maxwell's equations in vacuum. **2**

c) Show that the element dxdydz is not Lorentz invariant. **2**

d) State the wave equation. **2**

e) Obtain the relativistic addition law for velocities. **2**

f) How we confirm the constancy of the speed of light in inertial frames. **2**

g) Define the timelike & spacelike intervals. **2**

h) Define the world line & world points. **2**

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