



EASTERN UNIVERSITY, SRI LANKA

SECOND EXAMINATION IN SCIENCE - 2002/2003

(MARCH/APRIL 2004)

PH 205 RELATIVITY

Time: 01 hour.

Answer ALL Questions

---

1. (i) Derive the Lorentz Transformation equations.
- (ii) Write down the Lorentz Inverse Transformation equations.
- (iii) An inertial frame  $S'$  moving with velocity  $1.8 \times 10^8 \text{ms}^{-1}$  with respect to the frame  $S$  along the common  $XX'$  axis in such a way that the origins of the two frames coincide at  $t = t' = 0$ . Two events are recorded the frame  $S$ , one occurs at the origin ( $x_1 = 0$ ) at  $t_1 = 0$  and the other occurs on the  $X$ -axis at  $x_2 = 300\text{m}$  and  $t_2 = 1 \times 10^{-6} \text{sec}$ . Find the time interval between the events as measured in the frame  $S'$ .

2. derive an expression for the relativistic kinetic energy of a particle. From this deduce the expression for the non-relativistic kinetic energy of the particle.

- (i) Show the Energy-Momentum equation of the particle is given by

$$E^2 - p^2c^2 = m_0^2c^4.$$

The symbols have their usual meanings.

- (ii) A particle of rest mass  $m_0$  moving at a speed of  $\frac{4c}{5}$  collides with a similar particle at rest. If the two particles join together after the collision, show that
  - (i) The rest mass of the resulting particle is  $\frac{4m_0}{\sqrt{3}}$
  - (ii) The speed of the resulting particle is  $\frac{c}{2}$ .
  - (iii) The momentum of the resulting particle is  $\frac{4}{3}m_0c$ .