



EASTERN UNIVERSITY, SRI LANKA

SECOND EXAMINATION IN SCIENCE - 2003/2004

SECOND SEMESTER

(JUNE/JULY 2005)

PH 205 RELATIVITY

Time: 01 hour.

Answer ALL Questions

(Q1)

- i. Write down the Lorentz's transformation equations with clear symbols and definitions.
- ii. Explain what is meant by length contraction and time dilation in special relativity.
- iii. Consider two inertial frames S and S^1 having standard configuration. If two events occur along the X -axis at a distance d apart in the frame S simultaneously, and having corresponding separation of d^1 distance in the frame S^1 along the same axis. Prove that the relative velocity v between the frames is given by

$$v = \left[1 - \left(\frac{d}{d^1} \right)^2 \right] c$$

and the time interval between the occurrence of the events as measured in S^1 is

$$\Delta t^1 = \left[1 - \left(\frac{d}{d^1} \right)^2 \right]^{1/2} \left(-\frac{d^1}{c} \right)$$

(Q2)

Write the expression for the relativistic mass and describe clearly the symbols involved.

Write an expression for the relativistic momentum with clear symbolic definition.

- a) An external force F is applied on a particle where $F = \frac{dp}{dt}$, derive an expression for its kinetic energy.

Hence deduce the equation for the non-relativistic kinetic energy.

- b) Show that

$$E^2 = p^2 c^2 + m_0^2 c^4$$

where the symbols have their usual meaning

- c) A particle of rest mass m moving along the x -axis with velocity v collides with a particle of rest mass $\frac{m}{2}$ moving along the x -axis with velocity $-v$. If the two particles join together, show the rest mass of the resulting particle is

$$m_1 = \frac{m}{2} \sqrt{\frac{9 - v^2/c^2}{1 - v^2/c^2}}$$