EASTERN UNIVERSITY, SRI LANKA

SECOND EXAMINATION IN SCIENCE - 2003/2004

SECOND SEMESTER

(JUNE/JULY 2005)

REPEAT

PH 205 RELATIVITY

Time: 01 hour.

Answer <u>ALL</u> Questions

Q1)

i. Write down the Lorentz's transformation equations with clear symbolic definitions.

ii. Explain what is meant by length contraction and time dilation in special theory of relativity.

iii. Consider two internal 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 apart in the frame S^1 along the same axis. Prove that the relative velocity v between the frame is given by

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

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

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

(Q2)

Write the expression for the relativistic mass and describe clearly the each symbol involved.

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

a) An external force F is applied on a particle where $F = \dfrac{dp}{dt}$, derive an expression for its kinetic energy.
   Hence deduce the equation for the non-relativistic kinetic energy.

b) Show that

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

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 $m/2$ moving along the x-axis with velocity $-v$. If the two particles join together, show the rest mass of the resulting particle is

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