EASTERN UNIVERSITY, SRI LANKA

FIRST EXAMINATION IN SCIENCE - 2011/2012

FIRST SEMESTER (PROPER/REPEAT)

(February 2014)

PH 101 MECHANICS I

Time: 01 hour.

Answer ALL Questions

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1. (a) Define the terms instantaneous velocity and instantaneous acceleration of a particle.

   Instantaneous acceleration of a particle is given by $a = 3t^2\vec{i} + 4t\vec{j} + 5\vec{k}$ where a is in $m\sec^{-2}$ and t is in sec.

   (i) What is the acceleration of the particle when $t = 1\sec$.

   (ii) If the particle has a velocity $(\vec{i} + \vec{j} + \vec{k})m\,sec^{-1}$ at $t = 0$ determine the instantaneous velocity of the particle.

   (iii) The particle is located at (1,2,3) at $t = 0$. What is the displacement of the particle at $t = 2\,sec$.

   (b) A particle moves in two dimension and its position is given by the polar coordinates (r, θ). It moves along the curve $r = 3\theta$ and $\theta = t^2$.

   (i) Find the radial and transverse components of the velocity and acceleration of the particle.

   (ii) What is the velocity of the particle when $\theta = \frac{\pi}{3}$?

2. State Newton's second law and hence introduce the concept of impulse and conservation of momentum.

   A billiard ball with a velocity of 0.50 ms^{-1} collides head-on with another billiard ball of equal mass coming from the opposite direction with a velocity of 0.80 ms^{-1}. If the collision is elastic, what are the velocities of the two balls after they collide?