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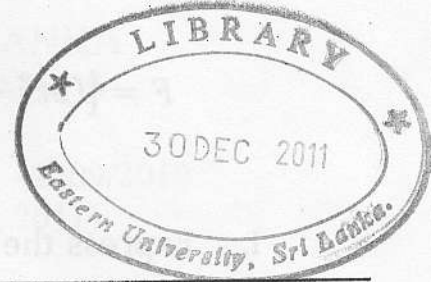
EASTERN UNIVERSITY, SRI LANKA
FIRST EXAMINATION IN SCIENCE - 2009/2010
FIRST SEMESTER (PROPER/REPEAT)

(June 2011)

PH 101 MECHANICS I

Time: 01 hour.

Answer ALL Questions



1. (a) Distinguish between average velocity and instantaneous velocity. Under what condition is the average velocity equal to instantaneous velocity.

A particle located at position $x = 0$ at time $t = 0$ starts moving along the positive x -direction with a velocity v that varies as $v = k\sqrt{x}$. How do the displacement, velocity and acceleration of the particle vary with time t ? What is the average velocity of the particle if it moves to a distance d in time t from rest?

- (b) A particle is moving in two dimensions and its position is given by the polar coordinates (r, θ) . Show that the velocity v and the acceleration a of the particle are given by:

$$v = \dot{r}e_r + r\dot{\theta}e_\theta$$

$$a = (\ddot{r} - r\dot{\theta}^2)e_r + (r\ddot{\theta} + 2\dot{r}\dot{\theta})e_\theta$$

where e_r and e_θ are the unit vectors along and perpendicular to the radial direction respectively.

2. Explain briefly what you mean by Kinetic energy, Potential energy, Work done, Work-Energy principal and Conservative force.

A particle with unit mass which is initially at rest, moves under the action of a force:

$$F = [(3t^2 + 1)\vec{i} + (2t + 3)\vec{j} + 4\vec{k}]N \text{ where } t \text{ is in sec.}$$

- i. Express the Newton's second law of motion and write down its mathematical representation.
- ii. Find the acceleration of the particle in terms of time t .
- iii. Find the velocity of the particle at time $t = 1$ and $t = 2$.
- iv. Determine the work done by the force when the particle moves from one point to another, in a time interval $t = 1$ and $t = 2$.
- v. Find the kinetic energy of the particle at time $t = 1$ and $t = 2$.
- vi. Verify the Work-energy theorem using your results for the previous parts.