EASTERN UNIVERSITY, SRI LANKA

FIRST EXAMINATION IN SCIENCE – 2013/2014

FIRST SEMESTER (PROPER/REPEAT)

(September/October 2015)

PH 101 MECHANICS I

Time: 01 hour.

Answer ALL Questions

---

1) Define the terms *work* and *power* in mechanics.

A particle of constant mass m moves under the influence of a force field $\underline{F}$. If the particle has respective velocities $\underline{V_1}$ and $\underline{V_2}$ at times t_1 and t_2, prove that the work-energy theorem can be expressed by,

$$\int_{t_1}^{t_2} \underline{F}.\underline{dr} = \frac{1}{2}m|V_2|^2 - \frac{1}{2}m|V_1|^2.$$

If a particle of mass $1\ kg$ moves in a force field $\underline{F} = 3t^2\underline{i} + 2t\underline{j}$ and has a velocity $3\underline{i} + 4\underline{j}$ at time $t = 0$, then find the velocity and momentum of the particle as a function of time. If the particle passes the points P_1 and P_2 at times $t = 1\ s$ and $t = 2\ s$ respectively, then find the

(i) kinetic energies of the particle at points P_1 and P_2.

(ii) work done in moving the particle from P_1 to P_2.

Hence, verify the work-energy theorem.

2) Describe collision and distinguish elastic collision from inelastic collision.

An electron of mass m engages in a head on elastic collision with an atom of mass M, which is at rest. As a result of the collision a characteristic amount of energy E is stored in the atom. Show that the minimum initial velocity of electron V_0 is,

$$V_0 = \left[2E\left(\frac{M+m}{Mm}\right)\right]^{1/2}.$$