EASTERN UNIVERSITY, SRI LANKA

SECOND EXAMINATION IN SCIENCE – 2013/2014

SECOND SEMESTER (October -2016)

PH 204 MECHANICS - II

ne: 01 hour.

swer ALL Questions

Show that the radial and transverse components of the acceleration of a particle in plane polar coordinates are given by $(\ddot{r} - r\dot{\theta}^2)$ and $(r\ddot{\theta} + 2\dot{r}\dot{\theta})$ respectively.

A particle of mass m moves in a central force field, with angular momentum L and potential energy $V(r)$. Show that the total energy of the particle is given by,

$$E = \frac{1}{2}m\dot{r}^2 + \frac{L^2}{2mr^2} + V(r)$$

Determine the centrifugal potential energy, and hence show the corresponding force acting on the particle is given by,

$$F_{cent} = mr\dot{\theta}^2$$

f the central force acting on the particle is given by $F(r) = {k}/{r^2}$, find the total energy of the particle.

02. State the Kepler's laws of planetary motion.

Define the term *gravitational field strength*.

The gravitational pull of Earth keeps a Satellite in a circular orbit. I magnitude of the gravitational force and centripetal force between the Earth Satellite. Hence, show that the period T of the Sattalite orbiting at a radiu given by,

$$T^2 = \frac{4\pi^2 r^3}{GM_E}$$

where, M_E and m are the masses of the Earth and Satellite respectively, Universal gravitational constant, and r is distance of Satellite from the Earth.

The Satellite orbits at a height of 80 km above the surface of Earth. Calc period of the orbit of the Satellite. Assume that the radius of Earth is 6.4 and $G = 6.67 \times 10^{-11} \, Nm^2kg^{-2}$.