

EASTERN UNIVERSITY, SRI LANKA

SECOND EXAMINATION IN SCIENCE - 2005/2006

SECOND SEMESTER (REPEAT)

(MARCH/APRIL 2008)

PH 204 MECHANICS II



Time: 01 hour.

Answer ALL Questions

1. A particle of mass  $m$  in a central force field  $F(r)$  moves with a constant angular momentum  $L$  about the force center. Show that the general equation of the particle's orbit is given by

$$\frac{d^2u}{d\theta^2} + u = -\frac{m}{L^2u^2} F\left(\frac{1}{u}\right)$$

where  $r$  and  $\theta$  are the plane polar coordinates of the particle and  $u = \frac{1}{r}$ .

If the particle describes the orbit

$$\frac{r}{R} = 1 + \cos\theta$$

where  $R$  is a constant, find the law of force  $F(r)$ .

2. State the Newton's law of gravitation. Express the acceleration due to gravity ( $g$ ), near the Earth's surface in terms of the mass ( $M$ ) and radius ( $R$ ) of the Earth. Show that the work done,  $W$  in moving a mass  $m$  from height  $h_1$  to height  $h_2$ , above the Earth's surface in a gravitational force field is given by

$$W = GMm \left( \frac{1}{R+h_1} - \frac{1}{R+h_2} \right).$$

If  $(h_1 - h_2)$  is small, show that this expression reduces to the standard form

$$mg(h_2 - h_1).$$