中國文化大學 100 學年度轉學招生考試

系組：物理學系三年級　　日期節次：7 月 26 日第 2 節 11:00-12:20

科目：**力學** (11-75)

1. A particle of mass m moves in the $x-y$ plane so that its position vector is $\vec{r}=r\cos(\omega t)\hat{i}+r\sin(\omega t)\hat{j}$, where r and ω are constants. Find the velocity and the acceleration. (15%)

2. The position of a particle is given by $\vec{r}=A(e^{\alpha t}\hat{i}+e^{-\alpha t}\hat{j})$, where α is a constant. Find the velocity and the acceleration. (15%)

3. A particle of mass m moves in the $x-y$ plane so that its position vector is $\vec{r}=a\cos(\omega t)\hat{i}+b\sin(\omega t)\hat{j}$, where a, b and ω are constants and $a>b$. (a) Show that the particle moves in an ellipse. (b) Show that the force acting on the particle is conservative. (20%)

4. Show by means of the substitution $r=\frac{1}{u}$ that the differential equation $m(\ddot{r}-r\dot{\theta}^2)=f(r)$ for the path of the particle in a central field can be written as

$$\frac{d^2u}{d\theta^2}+u=-\frac{1}{ml^2u^2}f(\frac{1}{u})$$. (20%)

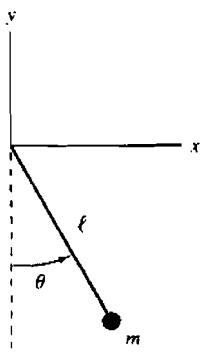

Fig.-1

5. As shown in Figure-1, use the (x,y) coordinate system to find (a)the kinetic energy T, the potential energy U, and the Lagrangian L for the case of a simple pendulum(with length ℓ, mass m) which is moving in a uniform gravitational field. Using Lagrangian formalism to find the equation of motion (b)in the (x,y) coordinate and (c)in the polar coordinate (r,θ). (30%)