| ⑧⑤學年度 | 國立成功大學 碩士班招生考試 | 物理研究所 所 古典力學 | 試題 | 共 1 頁 第 1 頁 |
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(1) To an observer in the rotating coordinates system, the effective force on a particle is given by
20%

$$\vec{F}_{eff} = m\vec{a}_r = \vec{F} - m\ddot{\vec{R}}_f - m\dot{\vec{\omega}}\times\vec{r} - m\vec{\omega}\times(\vec{\omega}\times\vec{r}) - 2m\vec{\omega}\times\vec{v}_r$$

(a) Explain the physical meaning of each term in the equation. (10%)

(b) Try to verify the equation. (10%)

(2). Use Kepler's Laws of planetary motion to show that the gravitational force must be central and that the radial dependance must be $1/r^2$.
20%

(3) A particle of mass m is constrained to move on the inside surface of a smooth cone of half-angle $\alpha$. The particle is subject to a gravitational force; (a) Determine a set of generalized coordinates and determine the constraints. (10%) (b) Find Lagrange's equations of motion. (10%)
20%

(4). Determine the eigenfrequencies and describe the normal mode motion for two pendula of equal length b and equal mass m connected by a spring of force constant K. The spring is unstretched in the equilibrium position.
20%

(5). Discuss the force-free motion of a symmetric top. 20%.

「Hints; Following equations are useful in solving your problems.

(1). $\frac{\alpha}{r} = 1 + \varepsilon\cos\theta$.

(2). $\frac{d^2}{d\theta^2}\left(\frac{1}{r}\right) + \frac{1}{r} = -\frac{\mu r^2}{\ell^2}F(r)$

(3). $(I_i - I_j)\omega_i\omega_j - \sum_k (I_k\dot{\omega}_k - N_k)\varepsilon_{ijk} = 0$ 」