淡江大學98學年度碩士班招生考試試題

系別：航空太空工程學系　　科目：動　力　學

准帶項目請打「V」	
V	簡單型計算機

本試題共 2 頁，4 大題

1. A point P moves on a spiraling path that winds around the parabolic of revolution shown in *Figure* 1. The focal distance f is 0.25 m, and the point P advances 4.0 m vertically with each revolution. If the speed of P is 0.7 *m/s* (a constant), determine the vertical component of the velocity vector of P as a function of r. (25%)

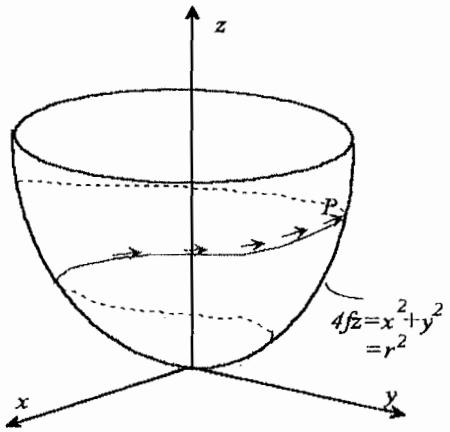

***Figure* 1.**

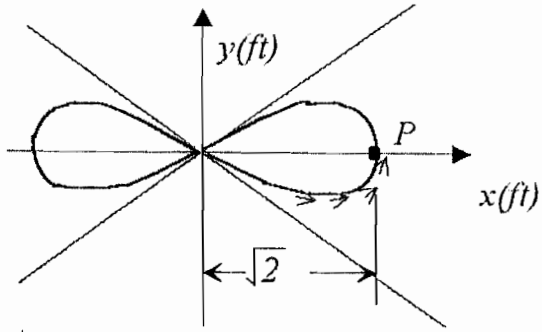

***Figure* 2.**

2. In the following problem

*** *** ***

A particle moves on a curve called the "*Lemniscate of Bernoulli*," defined by $r^2 = 2\cos 2\theta$ ft^2. It moves along the branch shown in *Figure* 2, with arrows, and passes through point P at $t = 0$. The angle θ increases with time according to $\theta = 3t^2 + 2t$ *rad*, with t measured in seconds. At the point P, find the radius of curvature of the path of P at the instant given.

*** *** ***

In the following solving procedures, explain which one is correct and why or why not (下列何種解答為正確？為什麼?). (25%)

***Sol* (1).**

$\theta = 3t^2 + 2t$, at t=0, and P at $(\sqrt{2},0)$, $\vec{v}_p = 2\sqrt{2}\vec{j}$, $\vec{a}_p = -12\sqrt{2}\vec{i} + 6\sqrt{2}\vec{j}$.

In the tangential-normal coordinate system, $\vec{a}_n = a_n\vec{e}_n = a_n(-\vec{i}) \Rightarrow a_n = 12\sqrt{2}$

Since $a_n = \dfrac{\dot{s}^2}{\rho} = \dfrac{(v_p)^2}{\rho} = \dfrac{(2\sqrt{2})^2}{\rho} = 12\sqrt{2} \Rightarrow \rho = \dfrac{\sqrt{2}}{3}$ $ft.$ #

***Sol* (2).**

$\rho = \dfrac{ds}{d\theta} = \dfrac{ds}{dt}\dfrac{dt}{d\theta} = \dfrac{ds/dt}{d\theta/dt}$, given $\theta = 3t^2 + 2t \Rightarrow \dfrac{d\theta}{dt} = 6t + 2$, $\dfrac{ds}{dt} = \dot{s} = |v_p| = 2\sqrt{2}$

Now at $t = 0$, $\Rightarrow \rho = \dfrac{2\sqrt{2}}{0+2} = \sqrt{2}$ $ft.$ #

本試題雙面印製

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12-2

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3. The rod ***AB*** shown in *Figure* 3, rotates clockwise such that it has an angular velocity ω_{AB} =3 *rad/sec* and angular acceleration $\alpha_{AB} = 4\ rad/sec^2$ when θ =45^0. Determine the angular motion (*i.e.* ω_{DE} **and** α_{DE}) of rod ***DE*** at this instant (答案請註明順時鐘或逆時鐘方向). The collar at ***C*** is pin connected to ***AB*** and slides over rod ***DE***. (25%).

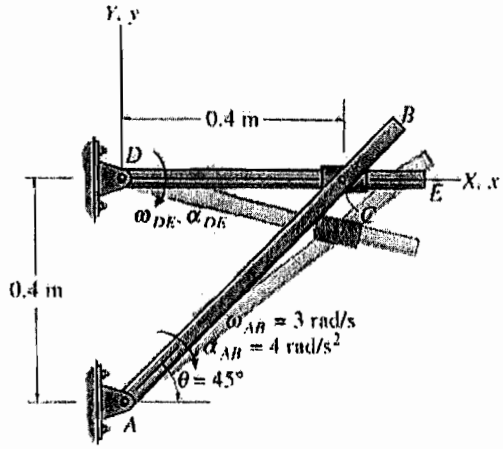

***Figure* 3.**

4. Find the **angle** θ for which the bar (mass *m*, length *L*) in *Figure* 4 will translate to the right at the given constant acceleration "*a*". Then **find** the **force** ***P*** required to produce this motion (assuming the friction coefficient between the bar and contact surface is μ). (25%)

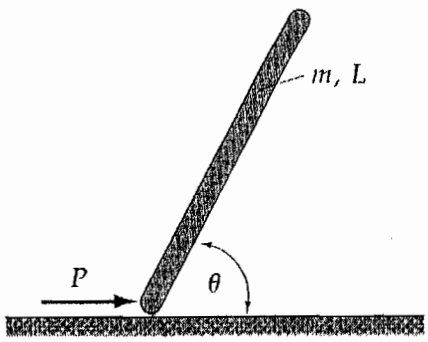

***Figure* 4.**