國立中央大學97學年度碩士班考試入學試題卷

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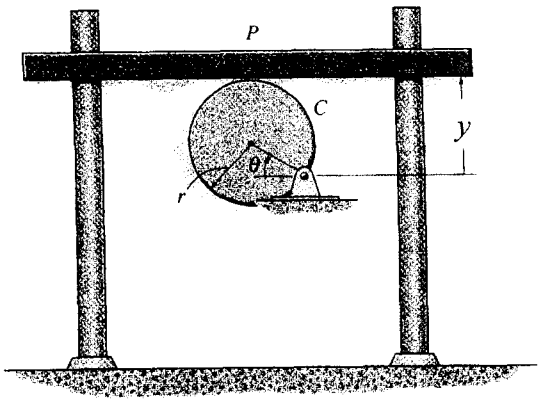
科目：動力學 共 1 頁 第 1 頁

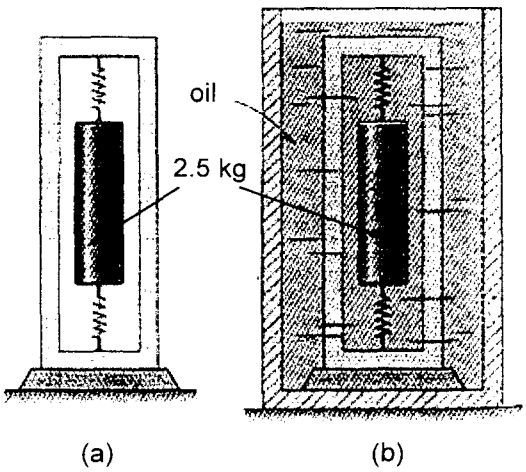
＊請在試卷答案卷（卡）內作答

1. **簡答題** (請務必以中文作答)
   (a) (10%) Polar coordinates system is a rotating coordinate system. Please determine whether the velocity and acceleration expressions $\vec{v} = \dot{r}\vec{e}_r + r\dot{\theta}\vec{e}_\theta$ & $\vec{a} = (\ddot{r} - r\dot{\theta}^2)\vec{e}_r + \left(r\ddot{\theta} + 2\dot{r}\dot{\theta}\right)\vec{e}_\theta$ represent absolute or relative motions. Please explain your reasons. Here, $\vec{e}_r$ and $\vec{e}_\theta$ are unit vectors in the radial and transverse directions, respectively.
   (b) (7%) Explain what conservative forces are.
   (c) (8%) Explain what D'Alembert principle is.

2. **(25%)** Determine the velocity and acceleration of platform P for any angle θ of cam C if the cam rotates with a constant angular velocity ω. The pin connection does not cause an interface with the motion of P on C. The platform is permitted to move vertically due to the smooth guides.



3. **(25%)** The 2.5-kg spring-supported cylinder is set into free vertical vibration and is observed to have a period of 0.75 s in part (a) of the figure. The system is then completely immersed in an oil bath in part (b) of the figure, and the cylinder is displaced from its equilibrium position and released. Viscous damping ensues, and the ratio of two successive positive-displacement amplitudes is 4. Calculate the viscous damping ratio ς, the viscous damping constant c, and the equivalent spring constant k.



4. **(25%)** The constant 40-N force is applied to the 36-kg stepped cylinder as shown in figure. The centroidal radius of gyration of the cylinder is $\bar{k}$ = 200mm, and it rolls on the incline without slipping. If the cylinder is at rest when the force is first applied, determine its angular velocity ω eight seconds later.