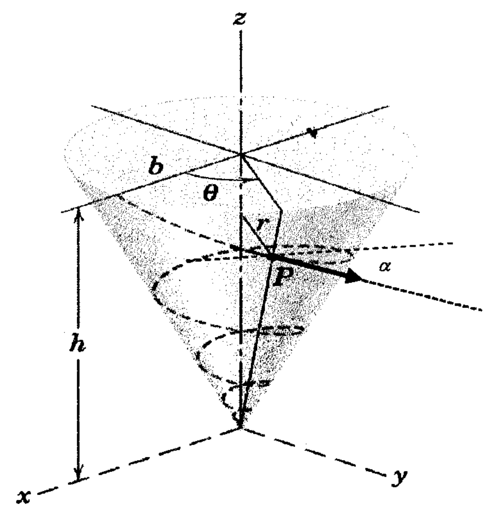
國立成功大學 104 學年度碩士班招生考試試題

系所組別：機械工程學系乙、戊組

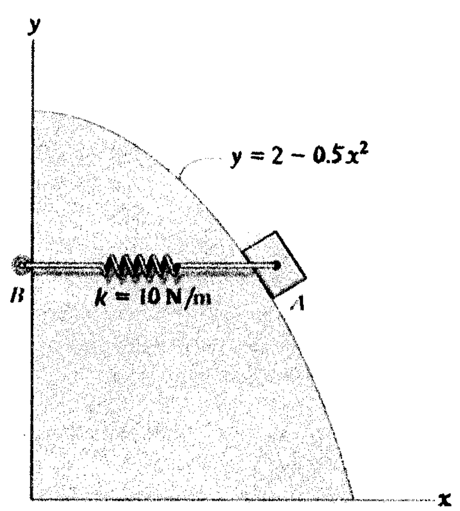
考試科目：動力學 考試日期：0211，節次：2

※ 考生請注意：本試題不可使用計算機。 請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. (25%) In following figure, a particle **P** moves down the spiral path which is wrapped around the surface of a right circular cone of base radius b and height h. The angle α between the tangent to the spiral path at any point and the horizontal tangent to the cone at same point is constant. The motion of **P** is controlled so that $\dot{\theta}$ is constant. Define the cylindrical coordinate system for describing the motion of P. Determine the velocity of the particle in terms of $\theta, \dot{\theta}, b, h$, and α. Determine the expression for the acceleration of the particle in terms of $\theta, \dot{\theta}, b, h$, and α for any value of θ. Assume $r = b$ when $\theta = 0$.



2. **(25%)** In following figure, the 6 kg block is confined to move along the smooth parabolic path. The attached spring restricts the motion and, due to the roller guide, always remains horizontal as the block descends. If the spring has a stiffness of k =10 N/m, and unstretched length of 0.76 m, determine the normal force of the path on the block at the instant x= 1 m when the block has a speed of 4 m/s. Also, what is the rate of increase in speed of the block at this point? Neglect the mass of the roller and the spring.



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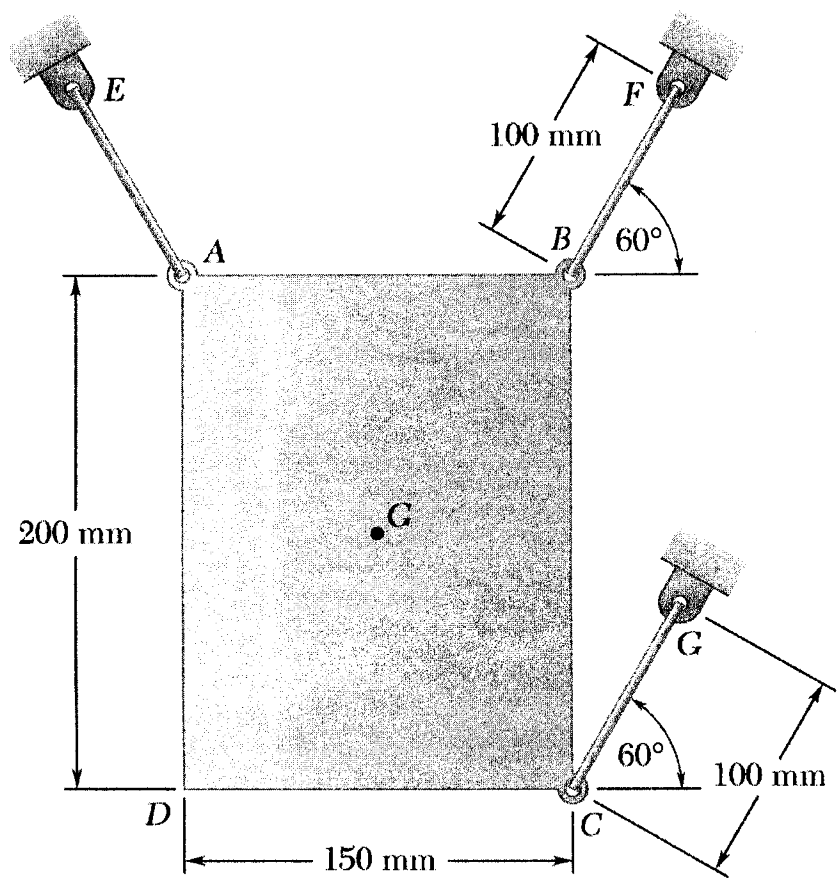
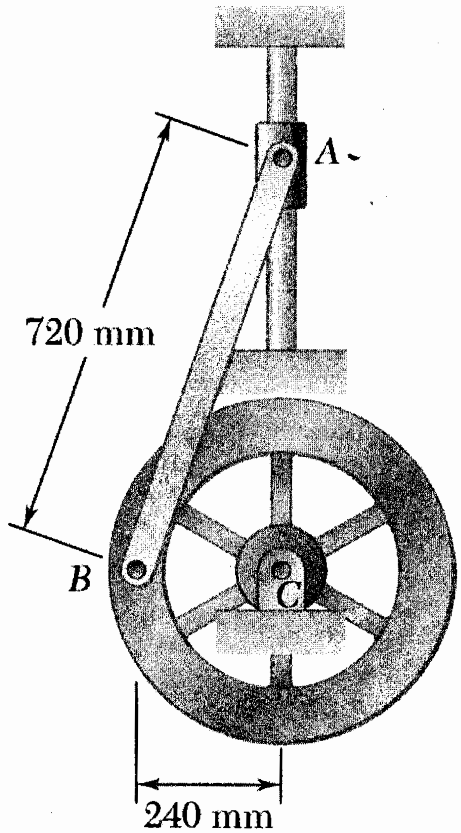
3. A uniform thin plate *ABCD* has a mass of 8 kg and is held in position by three inextensible cords *AE*, *BF*, and *CG*. If cord *AE* is cut, determine at that instant (a) if the plate is undergoing translation or general plane motion, (b) the tension in cords *BF* and *CG*. (20%)



4. The 4 kg rod *AB* is attached to a collar of negligible mass at *A* and to a flywheel at *B*. The flywheel has a mass of 16 kg and a radius of gyration of 180 mm. Knowing that in the position shown the angular velocity of the flywheel is 60 rpm clockwise, determine the velocity of the flywheel when point *B* is directly below *C*. (15%)



5. A homogeneous wire of length $2l$ is bent as shown in the figure and allowed to oscillate about a frictionless pin at B. Denoting the period of small oscillations by τ_o when $\beta = 0$, determine the angle β for which the period of small oscillations is $2\tau_o$. (15%)