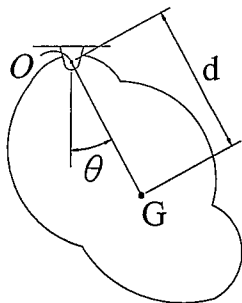


# 國立中山大學 101 學年度碩士暨碩士專班招生考試試題

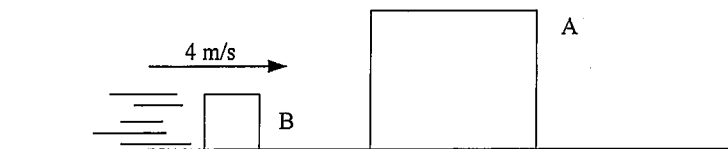
科目：動力學【機電系碩士班丁組】

題號：4095  
共 1 頁 第 1 頁

- (1) Show the natural frequency  $\omega_n$  of a 1-DOF system with mass  $m$  and stiffness  $k$ . (10%)
- (2) Determine the period of a harmonic motion with an amplitude of  $0.05 m$  and a frequency of 10 Hz. (10%)
- (3) The maximum amplitude and the maximum acceleration of the foundation of a centrifugal pump were found to be  $x_{\max} = 0.25 mm$  and  $\ddot{x}_{\max} = 0.4 g$  for its harmonic oscillation. Determine the operating speed of the pump ( $rpm$ ). (10%)
- (4) An automobile is found to have a natural frequency of  $20 rad/s$  without passengers and  $17.32 rad/s$  with passengers of mass  $500 kg$ . Determine the mass of the automobile by treating it as a single degree of freedom system. (10%)
- (5) The particular solution of the linear system  $m\ddot{x} + c\dot{x} + kx = F_0 \cos \omega t$  is given by  $x_p(t) = X \cos(\omega t - \phi)$ . Determine the amplitude  $X$  of the particular solution. (10%)
- (6) The body of arbitrary shape (Fig. 1) has a mass  $m$ , mass center at  $G$ , and a radius of gyration about  $G$  of  $k_G$ . If it is displaced a slight amount  $\theta$  from its equilibrium position and released, determine the natural period of vibration. (10%)



(Fig. 1)



(Fig. 2)

- (7) If a particle's position is described by the polar coordinates  $r = (2 \sin 2\theta) m$  and  $\theta = (4t) rad.$ , where  $t$  is in seconds. Determine the radial and tangential components of its velocity and acceleration when  $t = 1s$ . (20%)
- (8) As shown in Fig. 2, Block B has a mass of  $0.75 kg$  and is sliding forward on the smooth surface with a velocity  $(v_B)_1 = 4 m/s$  when it strikes the  $2-kg$  block A, which is originally at rest. If the coefficient of restitution between the blocks is  $e = 0.5$ , compute the velocities of A and B just after collision. (20%)