編號： 139 **國立成功大學 107 學年度碩士班招生考試試題**

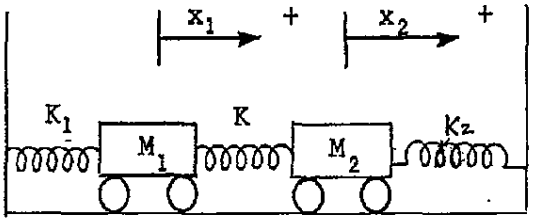
系　　所：航空太空工程學系

考試科目：動力學　　考試日期：0205，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。

25% Problem:

Two masses M_1 and M_2 connected with springs of negligible mass and spring constant K_1, K, K_2 move along a frictionless horizontal plane. Suppose that M_1 has a positive displacement of x_1 and M_2 has a positive displacement of x_2 from their position of equilibrium, Derive the dynamic equations of motion of M_1 and M_2. Note that both x_1 and x_2 are functions of time t.



25% Problem:

A uniform slender rod *AB* of mass *m* and length *L* is released from rest when $\theta = 60°$.

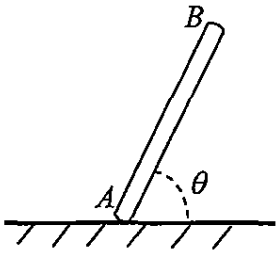
Suppose that the friction between end *A* and the surface is large enough to prevent sliding.

10% (A). What is the angular acceleration α of the rod just after release?

Hint: The moment of inertia of the rod with respect to point *A* is $\frac{1}{3}mL^2$.

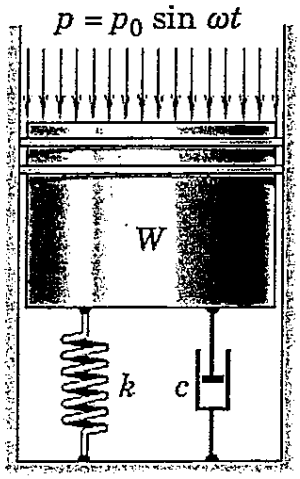
Let the gravitational acceleration be *g*.

15% (B). What is the minimum value of the coefficient of friction μ compatible with the desired motion?



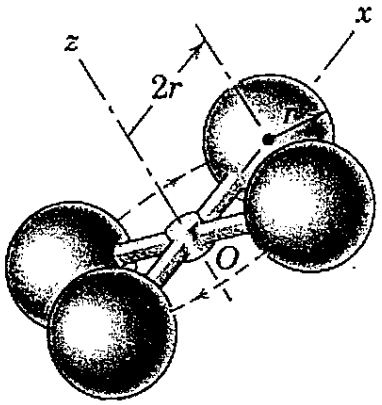
15% Problem:

The W lb piston is supported by a spring of modulus k lb/in. A dashpot of damping coefficient c lb-sec/ft acts in parallel with the spring. A fluctuating pressure $p = P_0 \sin \omega t$ in lb/in.^{2} acts on the piston, whose top surface area is A in.^{2} Determine the steady-state displacement as a function of time and the maximum force transmitted to the base.



20% Problem:

A proposed space station is closely approximated by four uniform spherical shells, each of mass m and radius r. The mass of the connecting structure and internal equipment may be neglected as a first approximation. If the station is designed to rotate about its z-axis at the rate of one revolution every 4 seconds, determine (a) the number n of complete cycles of precession for each revolution about the z-axis if the plane of rotation deviates only slightly from a fixed orientation, and (b) find the period T of precession if the spin axis z makes an angle of 20° with respect to the axis of fixed orientation about which precession occurs. Draw the space and body cones for this latter condition. (cos 20° = 0.9397, tan 20° = 0.3640)



15% Problem:

The uniform rectangular block of dimensions shown is sliding to the left on the horizontal surface with a velocity v_1 when it strikes the small step at O. Assume negligible rebound at the step and compute the minimum value of v_1 which will permit the block to pivot freely about O and just reach the standing position A with no velocity. Compute the percentage energy loss n for $b = c$.