

國立中山大學九十三年學年度轉學生招生考試試題

科目：工程數學【機電系三年級】

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[I] Find the solution to $y'' + y = \cos x$ that satisfies $y(0) = 2$ & $y'(0) = -3$. (20%)

[II] Find $x(t)$ & $y(t)$ for the simultaneous equations:

$$\frac{dx}{dt} = -4x - y$$

$$\frac{dy}{dt} = x - 2y$$

with $x(0) = 1$ & $y(0) = -1$. (20%)

[III] Determine the eigenvalues & the corresponding eigenvectors of matrix $[A]$,

$$\text{where } [A] = \begin{bmatrix} 1 & -1 & 4 \\ 3 & 2 & -1 \\ 2 & 1 & -1 \end{bmatrix} \quad (20\%)$$

[IV] Calculate a unit normal vector to the curve $f(t) = [(t^3/3) - t]i + t^2j$ at $t = 3$. (20%)

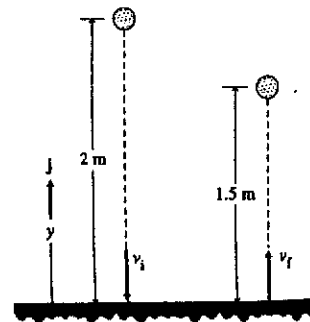
[V] Please describe the differences between hyperbolic type PDE, parabolic type PDE & elliptic type PDE, where PDE means partial differential equations. (20%)

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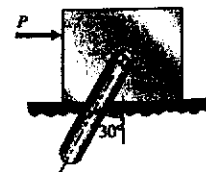
科目：應用力學【機電系三年級】

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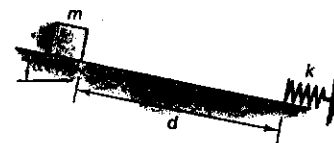
1. A golf ball that weighs 0.45 N is dropped from a height of 2 m above a floor. It rebounds vertically to a height of 1.5 m.
 - (a) Determine the momentum of the ball at the instant before and the instant after it strikes the floor.
 - (b) Estimate the time the ball is in contact with the floor, and determine the average force the floor exerts on the ball during the time.
 - (c) Determine the kinetic energy lost by the ball during contact with the floor. (20%)



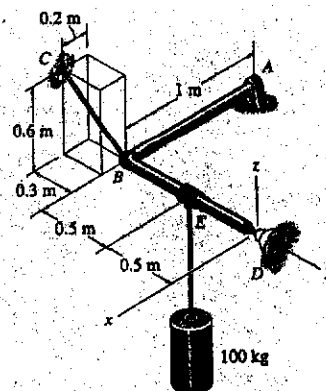
2. A bar weighs 360 N. It hangs from a frictionless pin B at the center of mass of a block that weighs 720 N. The block rests on a horizontal table. The coefficient of kinetic friction is 0.20. When a constant horizontal force P is applied centrally to a side of the block, the bar of length l maintains a 30° angle with the vertical. Determine the force P and the (x,y) projections of the force the pin exerts on the bar. (20%)



3. A block of mass m is released from rest to slide down a plane inclined at an angle α and with a coefficient of kinetic friction of μ_k . If a spring at the bottom of the incline is compressed to a maximum distance x , determine the distance d the block slides before it comes into contact with the spring. The spring has a spring constant of k . Discuss any limiting relationship between the incline angle and the coefficients of friction. (20%)



4. The bent rod is supported at A by a journal bearing, at D by a ball-and-socket joint, and at B by means of cable BC . Using only *one equilibrium equation*, obtain a direct solution for the tension in cable BC . The bearing at A is capable of exerting force components only in the z and y directions since it is properly aligned on the shaft. (20%)



5. If a force of 40 N is applied to the grip of the clamp, determine the compressive force F that the wood block exerts on the clamp. (20%)

