

國立清華大學 106 學年度碩士班考試入學試題

系所班組別： 動力機械工程學系碩士班 丙組

考試科目（代碼）：(1401) 工程力學

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1. For the system and loading shown, the quarter circular member CDE has a radius of 400 mm. Determine the force P required for equilibrium. Neglect the weights of all members in the system.

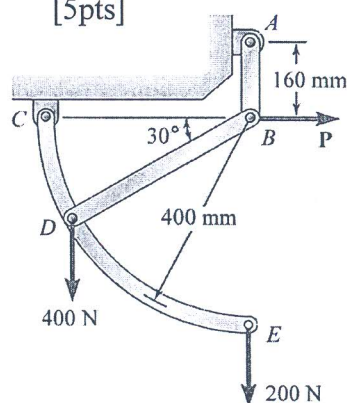
(a) Draw free-body diagram for the member CDE . [5pts]

(b) The corresponding force in member BD . [5pts]

(c) The corresponding reaction at C . [5pts]

(d) Draw free-body diagram for the member AB . [5pts]

(e) Find the force P required for equilibrium. [5pts]

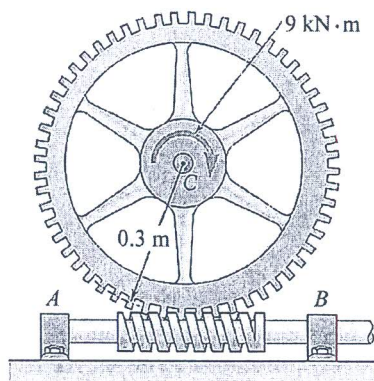


2. The square-threaded worm gear shown has a mean radius of 0.04 m and a lead of 0.01 m. The larger gear is subjected to a constant clockwise couple of 9 kN·m. The coefficient of static friction between the two gears is 0.12. Neglect the friction in the bearings at A , B , and C .

(a) Find the load applied on the worm gear. [5pts]

(b) Determine the couple that must be applied to shaft AB to rotate the large gear counterclockwise. [10pts]

(c) Determine the couple that must be applied to shaft AB to rotate the gear clockwise. [10pts]



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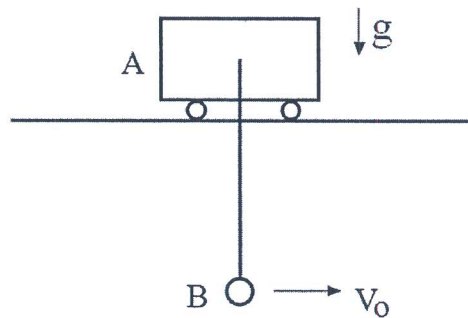
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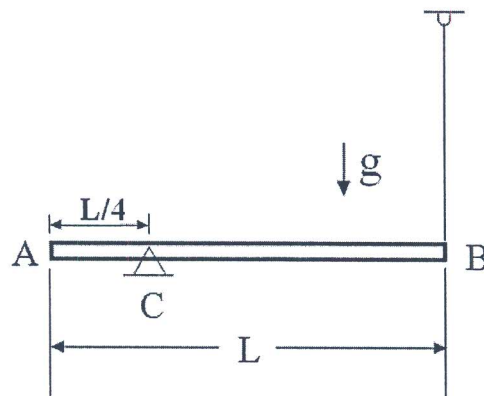
3. Small ball B of mass m_B , is suspended from a cord of length L attached to cart A , of mass m_A , which can roll freely on a frictionless horizontal track. If the ball is given an initial horizontal velocity v_0 while the cart is at rest, knowing that $v_0^2 < 2gL$, determine

- (a) the velocity of ball B as it reaches its maximum elevation, [8pts]
 (b) the maximum vertical distance h through which B will rise, and [8pts]
 (c) the maximum velocity of cart A can attain. [9pts]



4. A uniform slender rod AB of length L and mass m is supported as shown. If the cable attached at end B suddenly breaks, determine at that instance

- (a) the acceleration of end B , and [8pts]
 (b) the reaction at pivot C ; [8pts]
 also determine as the rod passes through a vertical position
 (c) the reaction at pivot C . [9pts]



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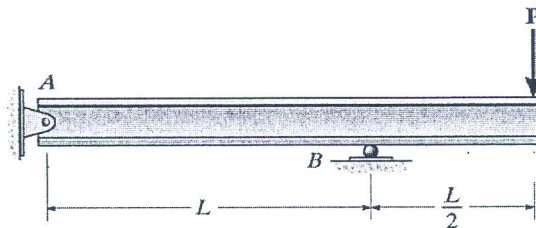
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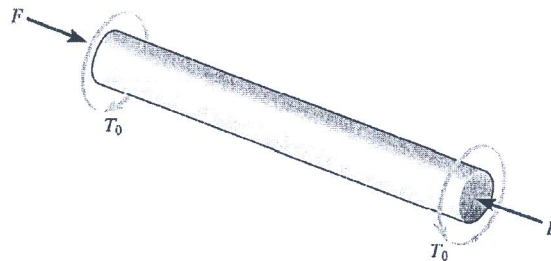
*請在【答案卷、卡】作答

5. For the following system, please



- (a) Draw free-body diagrams and calculate the reaction loads at point A and point B . [5pts]
- (b) Draw shear force – bending moment diagrams of the above beam, assuming constant EI , where E is Young's modulus and I is the beam's moment of inertia. [5pts]
- (c) Calculate the maximum normal stress and shear stress in the beam. The beam has rectangular cross sectional area having width w and the height h . [5pts]
- (d) Derive equation in terms of E , I , P and L to describe elastic curve of the beam. [5pts]
- (e) At point A , since it is pinned, what is the beam's deflection at this point due to load P ? What is the beam's slope at point A in terms of P , L , E , and I ? [5pts]

6. The solid shaft has a diameter d and is subjected to the loadings as shown below.



Please:

- (a) Determine the normal stress and shear stress on the surface of the shaft. [10pts]
- (b) Draw Mohr's circle. [5pts]
- (c) Determine the principle stresses and maximum in-plane shear stress that is developed anywhere on the surface of the shaft. [10pts]