題號： 346
科目： 應用力學(B)
節次： 4

國立臺灣大學 110 學年度碩士班招生考試試題

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1. **[16 points]** Define and describe the following terms:
   (1) Free-body diagram. (2) Wrench (in the force system). (3) Angular momentum. (4) Instantaneous center of rotation.

2. **[15 points]** Multiple-choice questions. Refer to the figures below.
   (1) For known forces that act on a two-dimensional structure, which of the following is true?
      (a) For external determinacy, it is an unstable structure. (b) For internal determinacy, it is an unstable structure.
      (c) There are 2 zero-force members in the structure. (d) All of the above.
   (2) A rectangular plate swings from arms of equal length as shown below. What is the magnitude of the angular velocity of the plate?
   (a) 0 rad/s (b) 1 rad/s (c) 2 rad/s (d) 3 rad/s (e) Need to know the location of the center of gravity.
   (3) If the clockwise angular velocity of crankshaft AB is constant, which of the following statement is true?
      (a) The angular velocity of BC is constant (b) The linear acceleration of point B is zero (c) The angular velocity of BC is counterclockwise (d) The linear acceleration of point B is tangent to the path.
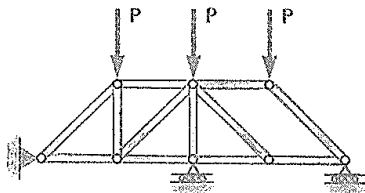
Problem 2.1
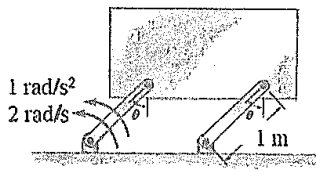
Problem 2.2

Problem 2.3

3. **[15 points]** The beam *AB* has a negligible mass and thickness and is subjected to a triangular distributed loading. It is supported at one end by a pin and at the other end by a post having a mass of 50 kg and negligible thickness. <u>Determine the two coefficients of static friction at *B* and at *C*</u> so that when the magnitude of the applied force is increased to $P = 150$ N the post slips at both *B* and *C* simultaneously.

4. **[20 points]** The vertical position of the 100-kg block is adjusted by the screw-activated wedge. <u>Calculate the moment *M*</u> which must be applied to the handle of the screw to raise the block. The single-thread screw has square threads with a mean diameter of 30 mm and advances 10 mm for each complete turn. The coefficient of friction for the screw threads is 0.25, and the coefficient of friction for all mating surfaces of the block and wedge is 0.40. Neglect friction at the ball joint *A*.

5. **[14 points]** A ball of negligible size and mass *m* is given a velocity of v_0 on the center of the cart which has a mass *M* and is originally at rest. If the coefficient of restitution between the ball and walls *A* and *B* is *e*, <u>determine the velocity of the ball and the cart just after the ball strikes *A*</u>. Also, <u>determine the total time needed for the ball to strike *A*, rebound, then strike *B*, and rebound and then return to the center of the cart</u>. Neglect friction.
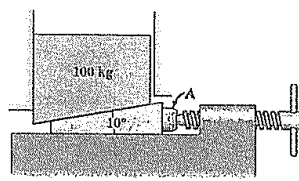
6. **[20 points]** The flexible band *F* is attached at *E* to the rotating sector and leads over the guide pulley *G*.
   (1) Determine the angular velocities of links *AB* and *BD* for the position shown if the band has a speed of 2 m/s.
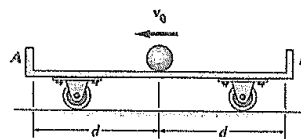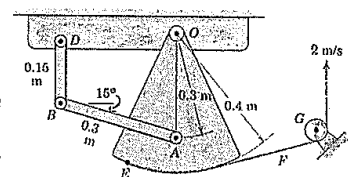   (2) Determine the angular acceleration α_{AB} of link *AB* and α_{BD} of link *BD*.
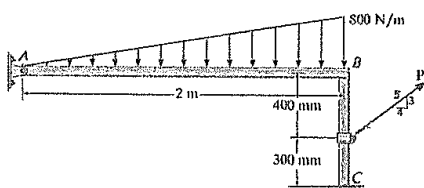
Problem 3

Problem 4

Problem 5

Problem 6

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