Prince of Songkla University

Faculty of Engineering

Final Examination Semester 2 Academic Year : 2004

Date : 25 February 2005 Time : 13.30-16.30

Subject : 226-305 Machine Design I Room : R300

ทุจริตในการสอบ โทษขั้นต่ำปรับตกในรายวิชานั้น และพักการเรียน 1 ภาคการศึกษา โทษสูงสุดให้ออก
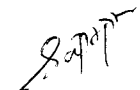
Instruction

1. There are 4 questions , 150 points.

2. Attempt to do all questions in test paper. If it isn't enough, you can use other blank pages.

3. Books, sheets of paper note ,a dictionary and a calculator are allowed.

4. Don't write in red pen.

No.	Full Score	Score
1	23	
2	30	
3	72	
4	25	
Total	**150**	

Asst.Prof. Pichet Trakarnchaisiri

Lecturer

1. A differential band brakes similar to the one shown in Figure 1 is being considered for use with a
   hoisted drum. With the hoist operating at rated load, a brake torque of 4000 N-m is required to
   hold the drum from slipping. The brake is to be designed to slip at a 15 percent overload.
   Available space limits the cast-iron brake drum diameter to 650 mm, with brake band contact
   extending over an angle of 250°. Design values for the brake lining selected are f = 0.40 and
   maximum pressure of 1.1 MPa. (23 points)

   1.1 Determine forces P_1 and P_2 corresponding to maximum brake torque and select an
       appropriate value of brake band width. (10 points)

   1.2 If distance **a** (in figure 1) is 120 mm, what value of distance **s** would enable the brake to
       be operated with a force F of 200 N at the end of a lever of length c = 650 mm?
       (5 points)

   1.3 Using the linkage dimensions from 1.2, what value of coefficient of friction would make
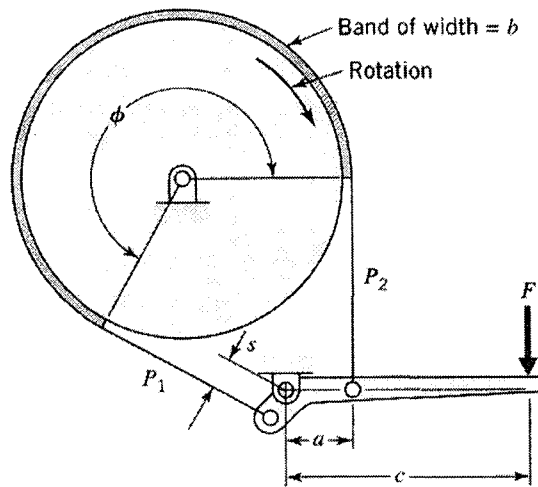   the brake self-locking? (8 points)

Figure 1

Name: .... ID. : ....

Major: ....   Page 4/13

2. Cantilever crank is welded with fillet weld shown in figure 2. Using E6012 welding rod

   (S_y = 345 MPa) and a safety factor of 3.0 based on yielding. (30 points)

   Assumption : - The cantilever crank itself doesn't fail. It will occur in the weld area.

   - The transverse shear stress in the weld is given by V/A where V is the shear

     force of 10 kN and A is the weld throat area.

   - For calculating moments of inertia of the weld linear segment, the effective

     weld width in the weld plane is the same as the throat length, t

   - The required weld leg size h is calculated using the 45° throat plan area.

   - The distortion energy theory is applicable.

   2.1 Find G ($\bar{x}, \bar{y}$) , I_u of weld pattern. (6 points)

   2.2 What are the resultant stresses at point B and C? (20 points)

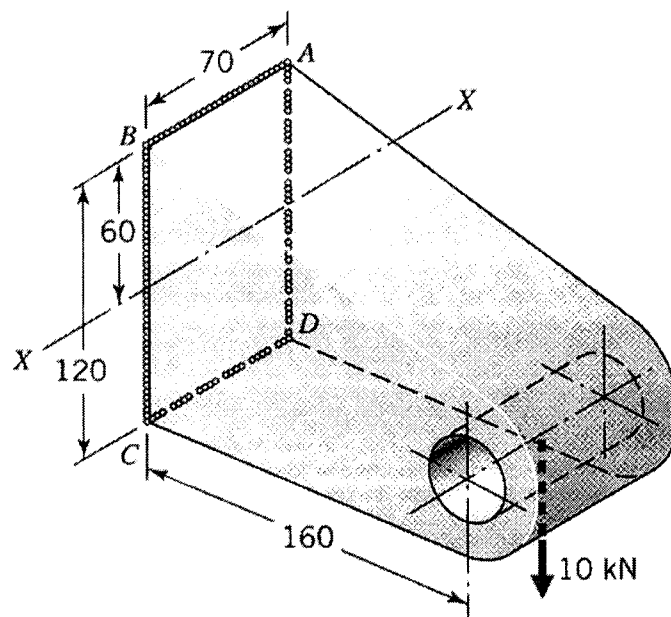   2.3 Determine the required weld leg size, h ,for weld pattern. (4 points)

Figure 2

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3. Figure 3 shows a printing roll driven by the gear to which the 1.2 kN force is applied by steady

torque.The bottom surface of the roll is in contact with a similar roll that applies a uniform(upward)

loading of 4 N/mm. The uniform shaft exerts a tension force of 1.0 kN. A steel has been tentatively

selected having AISI 1040 hot rolled, based on fatigue loading and a factor of safety of 3.5

(72 points)

      3.1 Calculate and draw Moment diagram on vertical, horizontal and resultant axis. (32 points)

      3.2 If the shaft rotates at 350 rpm, find the steady torque and torque power. (6 points)

      3.3 Determine the completely endurance limit of shaft. (10 points)

      3.4 Find the theoretical shaft diameter at critical points without yield damage. (6 points)

      3.5 If ball bearing code number 6306R is selected from KOYO catalog to support

          a printing roll by both of L_{10} bearing which have working life not less than 25,000 hr.

          The roll is worked in machinery with no impact, K_a = 1.2. Please show the process for

          checking bearing and determine if it is suitable. (18 points)
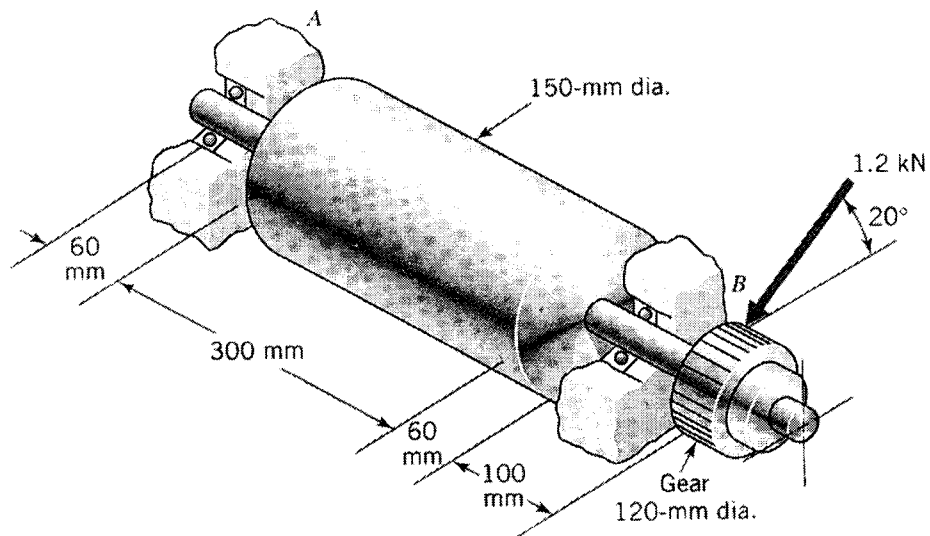

Figure 3

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4. A double strand roller chain is used to transmit power between a 13-tooth driving sprocket rotating

at 300 rev/min and a 52-tooth driven sprocket in a rubber mixer machine. (25 points)

   4.1 Find the AISI No. of roller chain for a 7.5-hp electric motor. (13 points)

   4.2 Determine an approximate center distance if the chain length is 82 pitches. (12 points)