คณะวิศวกรรมศาสตร์
มหาวิทยาลัยสงขลานครินทร์

การสอบปลายภาค ประจำภาคการศึกษาที่ 2 ประจำปีการศึกษา 2545

วันที่ 24 กุมภาพันธ์ พ.ศ. 2546 เวลา 13.30-16.30 น.

วิชา 217-313: การออกแบบเครื่องกล (Mechanical Design) ห้อง A201

<u>คำสั่ง</u>

1. ข้อสอบมีทั้งหมด 6 ข้อ แต่ละข้อมีคะแนนเท่ากัน
2. ให้ทำทุกข้อลงในสมุดคำตอบ ใช้ดินสอได้
3. นำเอกสารทุกชนิดเข้าห้องสอบได้

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ผู้ออกข้อสอบ

1. The compression helical spring shown in figure 1 is made of spring steel wire having a shear yield strength of 640 MPa, and a shear modulus of 79 GPa.

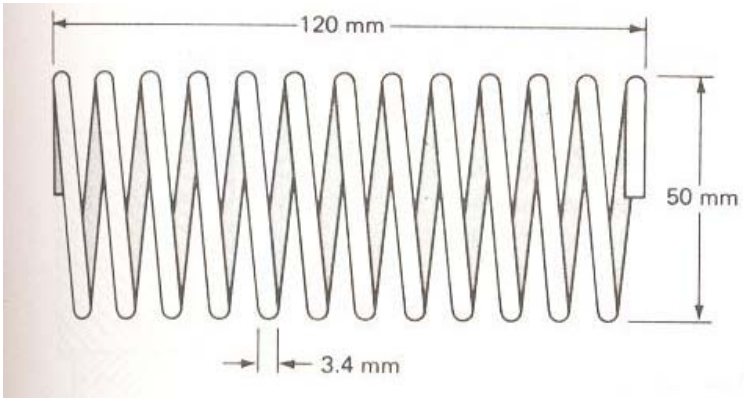

Figure 1

(a) Compute the spring rate

(b) What force is required to close the spring to its solid height?

(c) After the spring has been closed to its solid height once, and the compressive force removed, will it spring back to its original free length?

2. The steel bar is to be fastened to the C channel with three M12x1.75 bolts at A, O, and, B as shown in figure 2 .Determine the maximum applied F if allowable shear stress in the bolts is 346 MPa. (The dimensions given are in mm)

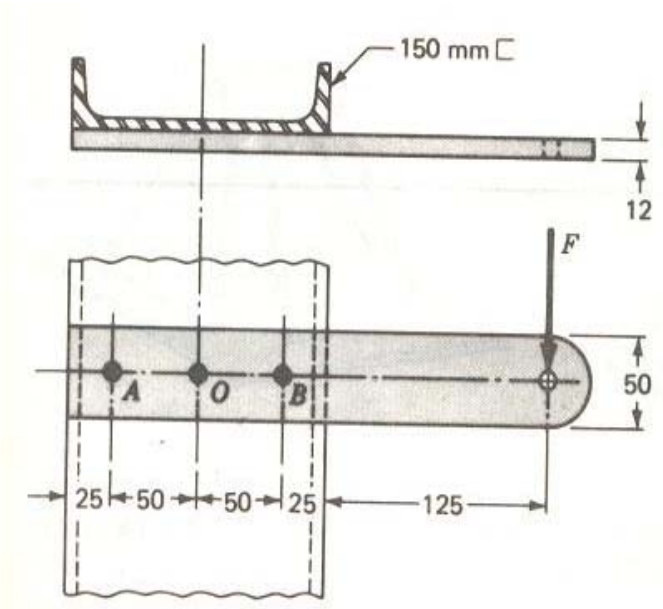

Figure 2

3. Determine the maximum total load F that the welded joint in figure 3 can support, with a safety factor of 3.0. The weld legs are 3 mm wide and the yield strength of weld material is 350 MPa. Assume the load is equally divided between the two sides.

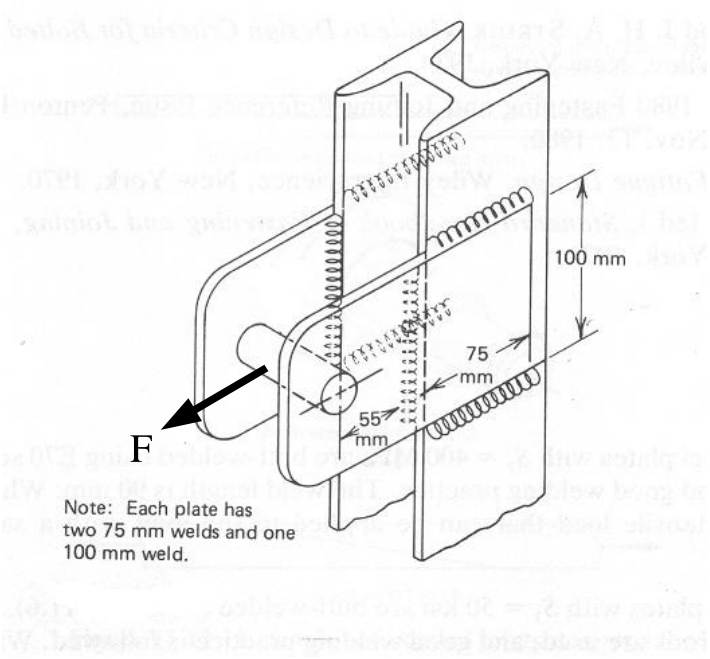

Figure 3

4. The hand brake shown in figure 4 has a face width of 45 mm. (Dimensions are in mm.) The frictional material permits a maximum pressure of 550 kPa (computed from projected area) with a coefficient of friction of 0.24. Use short-shoe type computation.

   (a) Determine the force F.

   (b) What is the torque capacity?

   (c) If the speed is 100 rev/min and the brake is applied for 5 seconds at full capacity to bring the shaft to a full stop, how much heat is generated?

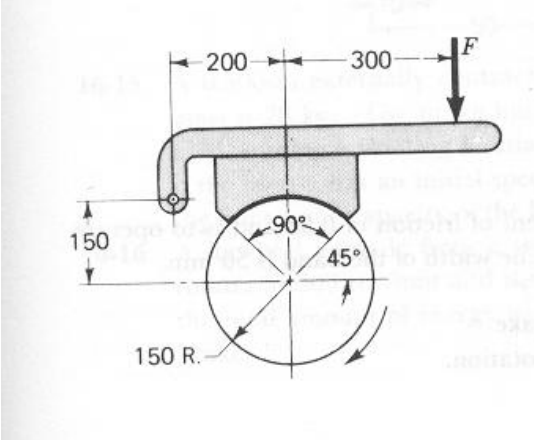

Figure 4

5. Find the maximum power that can be transmitted by the smaller pulley of a V-belt drive under the following conditions: pulley speed = 4000 rpm, r = 100 mm, β = 18°, ϕ = 170°, f = 0.20, belt maximum tension = 1300 N, and belt unit weight = 1.75 N/m.

6. A No.208 angular contact ball bearing (α = 25°) is used in the application considered to be uniform loading. The shaft speed is 4000 rpm, and the bearing is subjected to a radial load of 1000 N and an axial load of 2000 N. Estimate the bearing life in hours for 95% reliability.