Prince of Songkla University

Faculty of Engineering

Midterm Examination Semester 2   Academic Year : 2004

Date : 21st December 2004   Time : 13.30-16.30

Subject : 226-305 Machine Design I   Room : R300

Instruction

1. There are 4 questions , 140 scores.

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.

> **ทุจริตในการสอบโทษขั้นต่ำ คือ ปรับตกในรายวิชาที่ทุจริต**
>
> **และพักการเรียน 1 ภาคการศึกษา**

No.	Full Score	Scores
1	45	
2	50	
3	20	
4	25	
Total	**140**	

Mr. Pichet Trakarnchaisiri

Lecturer

1. Figure 1 shows a hand crank is made of gray cast iron – class 40 with static vertical load 1000 N applied to the handle. (45 scores)

   1.1 Determine the location (select point A,B,C and D on hand crank surface) of highest bending stress and calculate. (neglect stress concentration) (5 scores)

   1.2 Determine the location (select point A,B,C and D on hand crank surface) of highest combined torsional and transverse shear stress and calculate at the selected point (neglect stress concentration) (10 scores)

   1.3 Compute safety factors of ultimate strength, for stress element at point A and B. Based upon the modified Mohr theory. (30 scores)
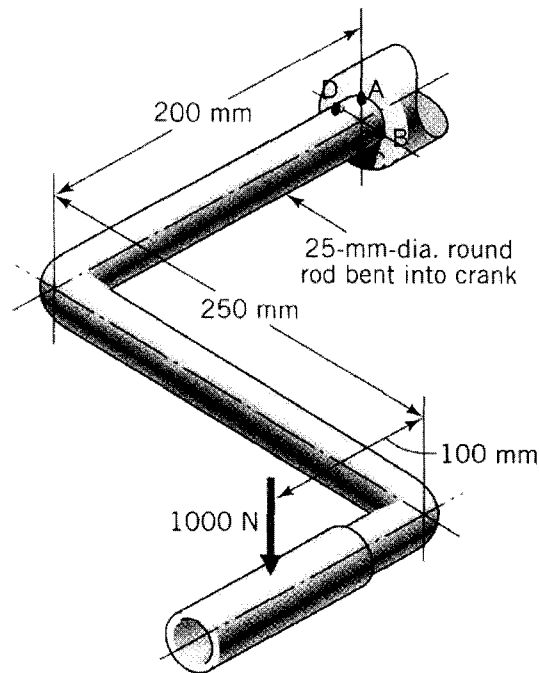

200 mm

D A
B

25-mm-dia. round
rod bent into crank

250 mm

100 mm

1000 N

Figure 1

2　In figure 2 shows a round shaft and a torque fluctuation to which it is subjected. The material is

carbon steel AISI 1050 hot rolled and has reliability of 90%. All surfaces are ground. Estimate the

safety of factors for infinite fatigue in critical position of both shoulders at this shaft.
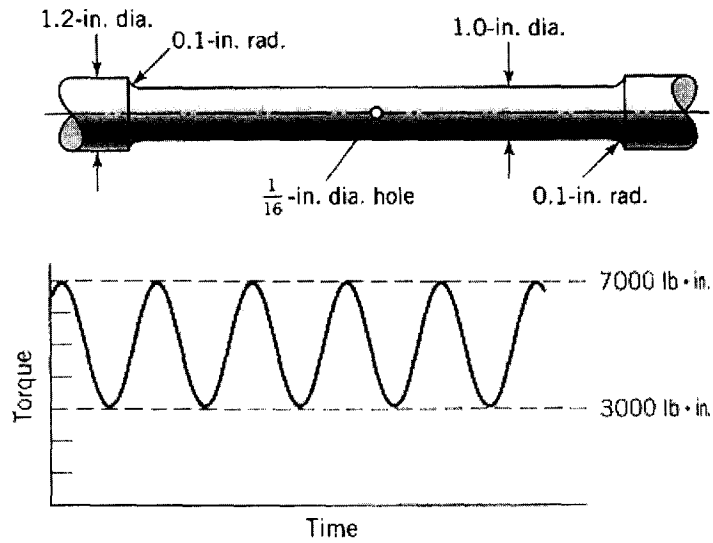
(Assumption : $K_{fm} = K_f$) (50 scores)

Figure 2

3. Figure 3 shows a wheel chair brake in its retracted position ,with a tension spring exerting a

    force 4 N , which holds the handle against the pin stop. When the handle is moved clockwise ,

    pivot A drops below the hold the brake shoe against the tire. Chrome vanadium (modulus of

    rigidity G = 80.8 GPa) ,ASTM A232 spring with wire diameter 1.0 mm is used to work at

    lowest of pre-tension. (20 scores)

    3.1   Determine a satisfactory combination of diameter coil spring (D) and initial tension

            force (F$_i$) by defined C = 10. (10 scores)

    3.2   If body-length of tension spring is to 30 mm. Determine a spring rate and maximum

            deflection of spring. (10 scores)
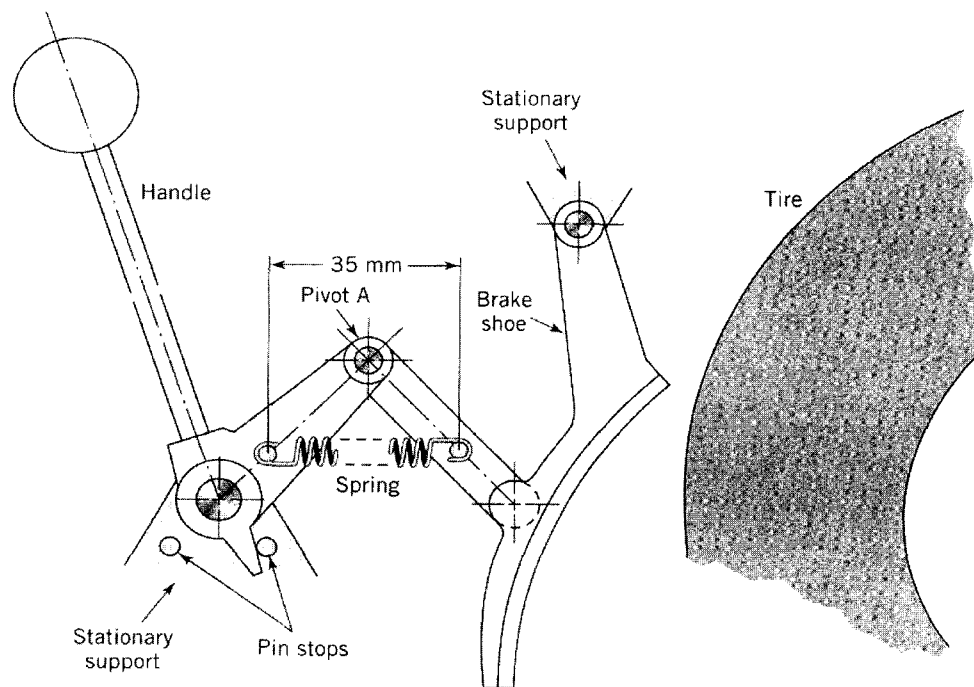

Figure 3

4. In Figure 4, a screw jack with a 1-in.,single-thread ACME screw is used to raise a load of 1000 lb.

    A plain thrust collar of 2½ -in. mean diameter is used. Coefficients of running friction are

    estimated as 0.15 and 0.10 for f and f_c, respectively. (25 scores)

    4.1 Determine the screw pitch, lead, thread depth, mean pitch diameter and helix angle.

    (10 scores)

    4.2 Estimate the starting torque for raising and for lowering the load. (10 scores)

    4.3 Estimate the efficiency of the jack when raising the load. (3 scores)

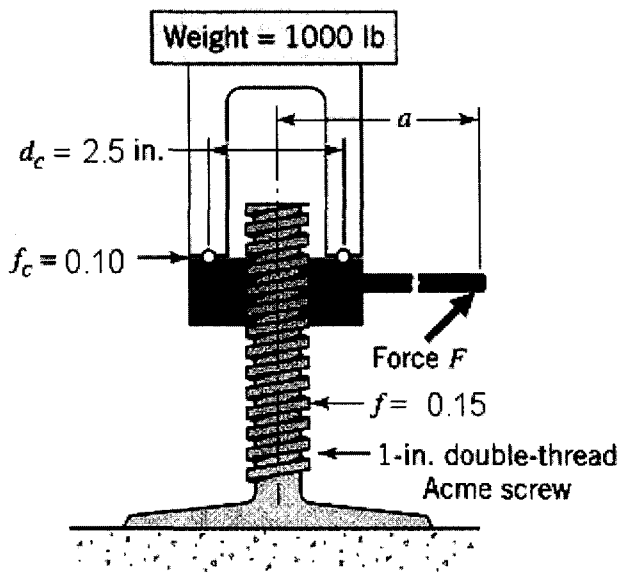   4.4 Do you think the screw is self-locking or back-driving? Give a reason. (2 marks)

Figure 4