

CE 203 STRUCTURAL MECHANICS I (Section 3)

Second Semester 1429 / 2008 (072)

H.W. # 6

Due on Sunday 29-3-1429 / 6-4-2008 (any time)

Deadline for submission: **Monday 1-4-1429 / 7-4-2008 (before you sit in class)**

- 1) Pulleys are securely attached to a 1.5-in.-diameter aluminum ($G = 4 \times 10^6$ psi) rod as shown in Fig. P1. Four vertical forces of magnitude P cause the pulley at A to rotate 5 degrees relative to the pulley at B . Determine the value of P and the maximum shear stress in the rod. [Secs. 5.1, 5.2, 5.4] (20 pts.)
- 2) Establish formulas for the reactions of the rigid supports at A and B on the shaft shown in Fig. P2. Establish a formula for the maximum shear stress. Express your results in terms of T_0 , a , b , d , and ℓ . [Sec. 5.5] (15 pts.)
- 3) The allowable shear stress for either the aluminum or steel portions of the step-shaft shown in Fig. P3 is 55 MPa. Determine the maximum permissible T_0 that can be applied to the shaft. $G_{AL} = 28$ GPa and $G_{ST} = 84$ GPa. [Sec. 5.5] (25 pts.)
- 4) The steel shaft shown in Fig. P4 is required to transmit 20π HP at 5.5 Hz. If the allowable angle of twist per meter of shaft is not to exceed 4.5 degrees, and if the allowable shear stress is not to exceed 84 MPa, calculate the minimum permissible diameter d . [Sec. 5.3] (15 pts.)
- 5) A pump is connected to an electric motor through steel shafting as shown in Fig. P5. An offset necessary to connect the pump to its power source is provided by the gear arrangement as shown. If the motor delivers 100π HP at 330 rpm at its shaft, determine
 - (a) the maximum shear stress in the shaft and
 - (b) the relative rotation of sections A and C ($G = 12 \times 10^6$ psi for steel). [Sec. 5.3] (25 pts.)

Fig. P1

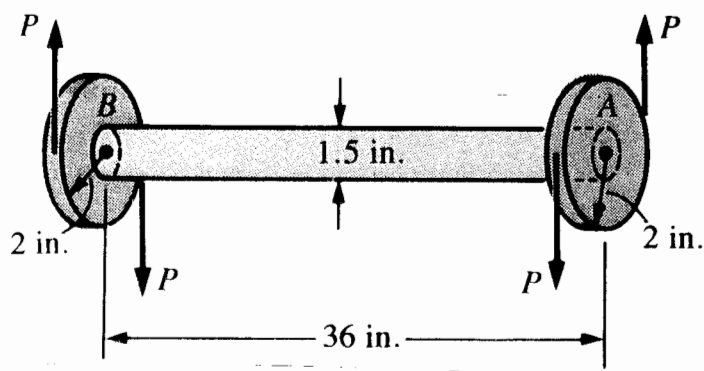


Fig. P2

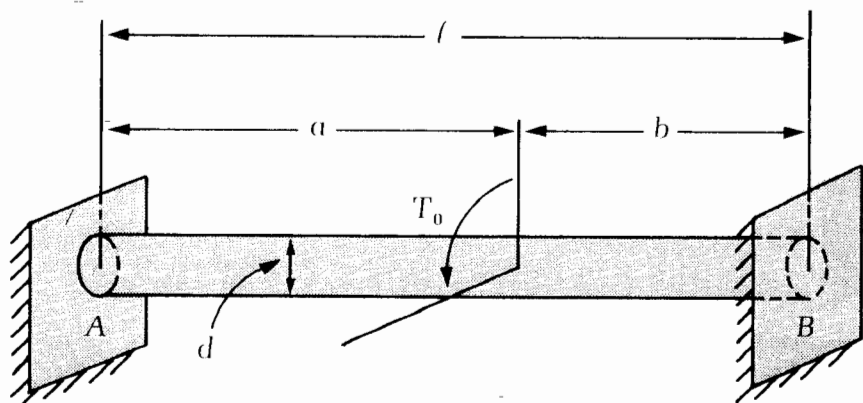


Fig. P3

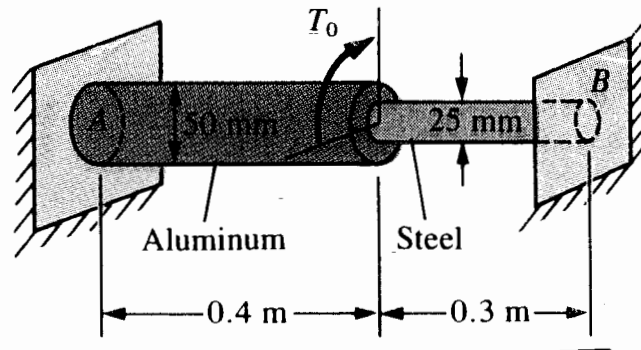


Fig. P4

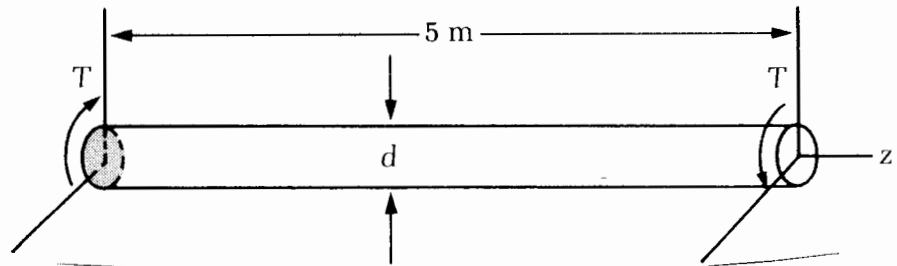
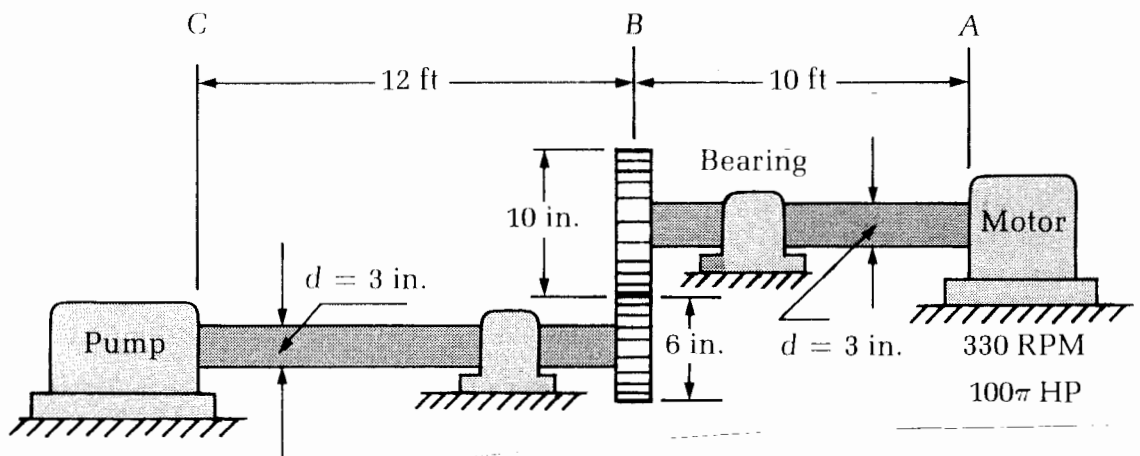


Fig. P5



Do your work yourself!! Remember that the homework carries 20% of the course grade; in addition, *solving it is the best way to understand the subject.* Of course, you can seek my help anytime in the homework as well as in anything else.

As an engineer, review the guidelines for submitting homework assignments given to you in class BEFORE you start solving and writing the homework. FOLLOW ALL THESE GUIDELINES. Cheating, copying, etc. is!!!!!!