MECH 325
Homework Assignment #3
Due Nov. 12

Problem 1 (Question 12-26)

12–26 An Oiles SP 500 alloy brass bushing is 0.75 in long with a 0.75-in dia bore and operates in a clean environment at 70°F. The allowable wear without loss of function is 0.004 in. The radial load is 400 lbf. The shaft speed is 250 rev/min. Estimate the number of revolutions for radial wear to be 0.004 in.

Problem 2 (Question 12-27)

12–27 Choose an Oiles SP 500 alloy brass bushing to give a maximum wear of 0.002 in for 1000 h of use with a 200 rev/min journal and 100 lbf radial load. Use $h_{CR} = 2.7$ Btu/(h · ft^2 · °F), $T_{max} = 300$°F, $f_s = 0.03$, and a design factor $n_d = 2$. The bearing is to operate in a clean environment at 70°F. Table 12–12 lists the bushing sizes available from the manufacturer.

Problem 3 (Question 11-3)

An angular-contact, inner ring rotating, 02-series ball bearing is required for an application in which the life requirement is 40 kh at 520 rev/min. The design radial load is 725 lbf. The application factor is 1.4. The reliability goal is 0.90. Find the multiple of rating life x_D required and the catalog rating C_{10} with which to enter Table 11–2. Choose a bearing and estimate the existing reliability in service.

Problem 4 (Question 11-23)

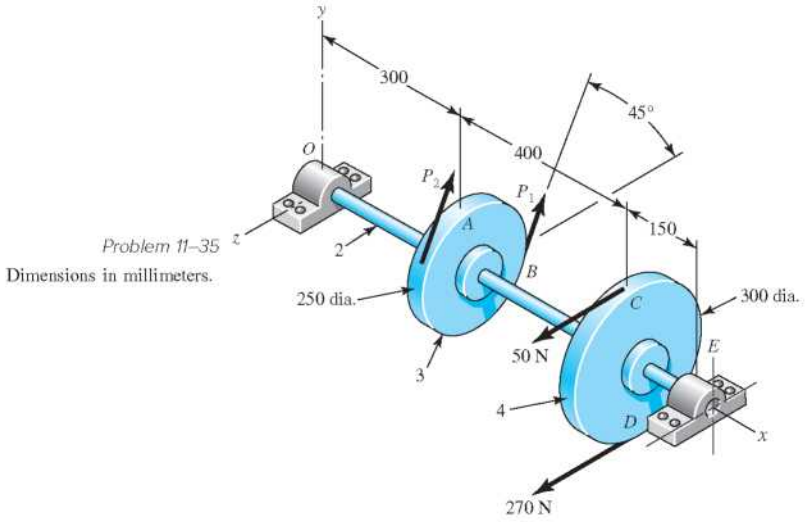
An 02-series single-row deep-groove ball bearing with a 30-mm bore (see Tables 11–1 and 11–2 for specifications) is loaded with a 2-kN axial load and a 5-kN radial load. The inner ring rotates at 400 rev/min.

(*a*) Determine the equivalent radial load that will be experienced by this particular bearing.

(*b*) Determine the predicted life (in revolutions) that this bearing could be expected to give in this application with a 99 percent reliability.

Problem 5 (Question 11-35)

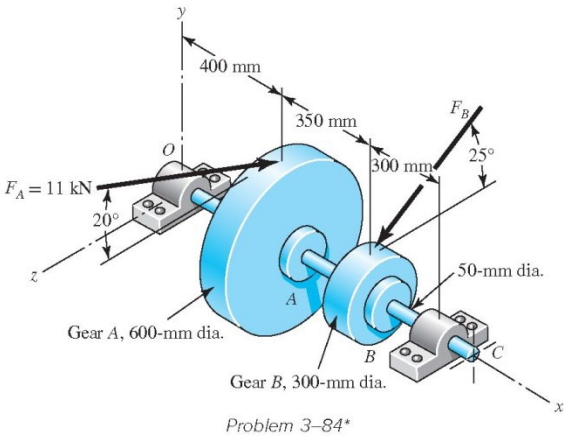
The figure is a schematic drawing of a countershaft that supports two V-belt pulleys. The countershaft runs at 1500 rev/min and the bearings are to have a life of 60 kh at a combined reliability of 0.98, assuming distribution data from manufacturer 2 in Table 11–6. The belt tension on the loose side of pulley *A* is 15 percent of the tension on the tight side. Select deep-groove bearings from Table 11–2 for use at *O* and *E,* using an application factor of unity.



Problem 6 (Question 7-40)

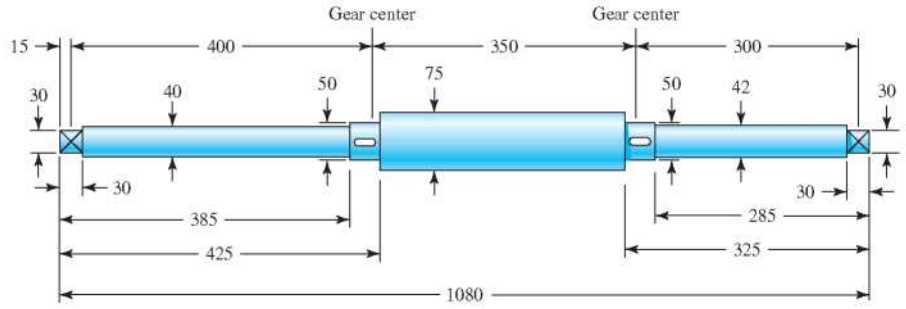
A gear reduction unit uses the countershaft shown in the figure. Gear *A* receives power from another gear with the transmitted force F_A applied at the 20° pressure angle as shown. The power is transmitted through the shaft and delivered through gear *B* through a transmitted force F_B at the pressure angle shown.

(*a*) Determine the force F_B, assuming the shaft is running at a constant speed.
(*b*) Find the bearing reaction forces, assuming the bearings act as simple supports.
(*c*) Draw shear-force and bending-moment diagrams for the shaft. If needed, make one set for the horizontal plane and another set for the vertical plane.
(*d*) At the point B, determine the maximum bending moment, the bending stress and the torsional shear stress.



*Problem 3–84**

The shaft shown in the figure below is proposed for the application above. The material is AISI 1018 cold-drawn steel. The gears seat against the shoulders and have hubs with setscrews to lock them in place. The effective centers of the gears for force transmission are shown. The keyseats are cut with standard endmills. The bearings are press-fit against the shoulders.



*Problem 7–26**

All fillets 2 mm.
Dimensions in mm.

(e) Specify a square key for gear B, using a factor of safety of 1.1.