|  |  |
| --- | --- |
| 7.1)A shaft is loaded in bending and torsion such **that *Ma* 570N**/m, ***Ta* 545N/**m, ***Mm*  = 55 N**/m, and ***Tm* = 35 N/m**. For the shaft, ***Su* = 700 MPa** and ***Sy*  = 60 MPa**, and a fully corrected endurance limit of ***Se* = 210 MPa** is assumed. Let ***Kf* = 2.2** and ***Kfs* = 1.8**. With a **design factor of 2.0** determine the minimum acceptable diameter of the shaft using the  (*a*) DE-Gerber criterion. (*b*) DE-ASME Elliptic criterion. (*c*) DE-Soderberg criterion. (*d*) DE-Goodman criterion. Discuss and compare the results. |  |

|  |  |
| --- | --- |
| 7.3)  The rotating solid steel shaft is simply supported by bearings at points *B* and *C* and is driven by a gear (not shown) which meshes with the spur gear at *D*, which has a 150-mm pitch diameter. The force *F* from the drive gear acts at a pressure angle of 20°. The shaft transmits a torque to point *A* of *TA* = 340 N ? m. The shaft is machined from steel with *Sy* = 420 MPa and *Sut* = 560 MPa. Using a factor of safety of 2.5, determine the minimum allowable diameter of the 250-mm section of the shaft based on  (*a*) a static yield analysis using the distortion energy theory and  (*b*) a fatigue-failure analysis. Assume sharp fillet radii at the bearing shoulders for estimating stress-concentration factors. |  |