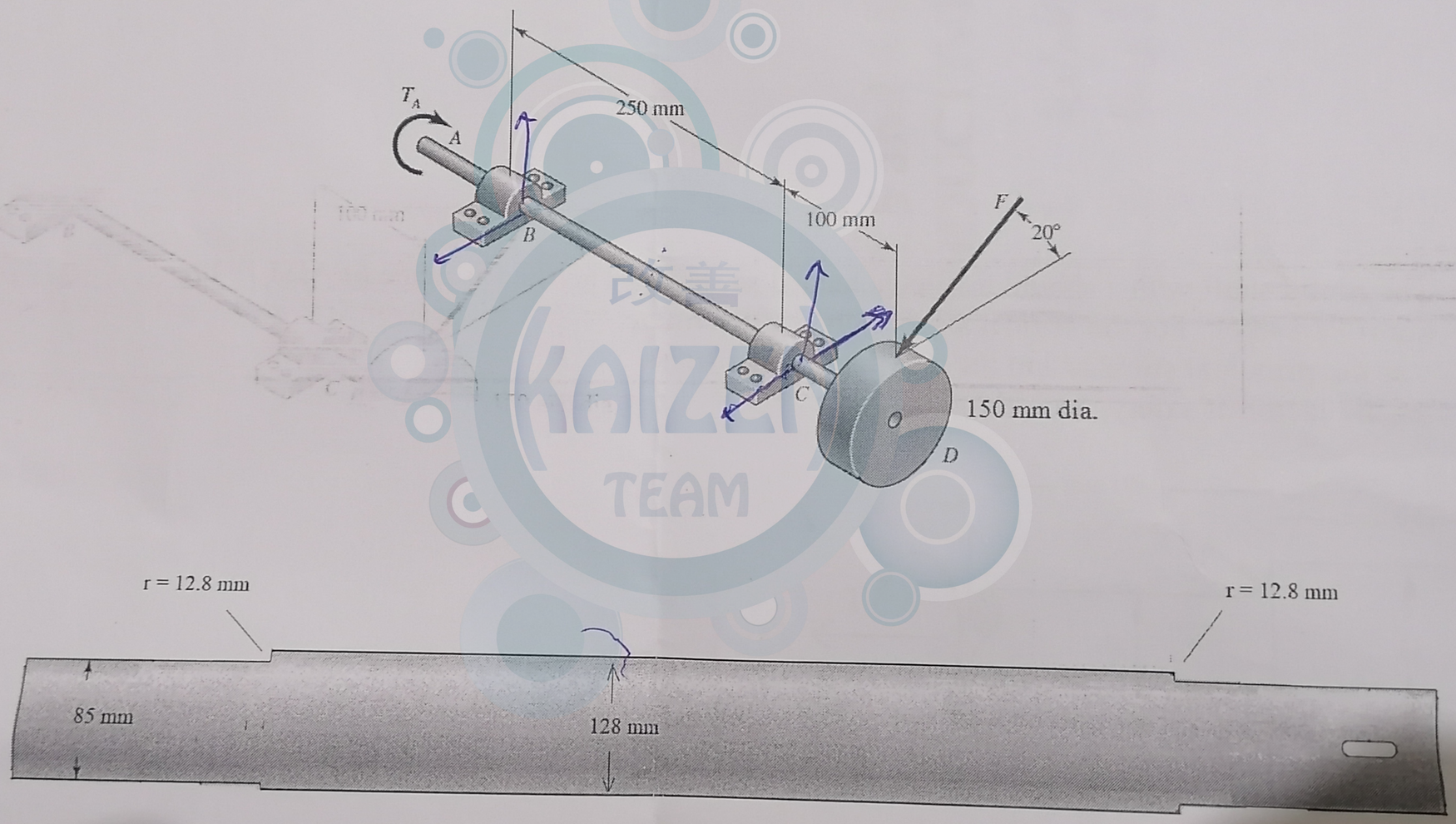
Q3(20 P). The figure shows a shaft simply supported by bearings at *B* and C and having a pulley at D. The bearings are to have a life of 8 kh at a combined reliability of 0.98. The shaft transmits a torque to point *A* of $T_A = 440$ N ·m. The shaft is made of AISI 1050 hot rolled steel.

a-select deep-groove bearings for use at B and C, using an application factor of unity if the shaft rotates with a speed of 80 rev/min.

c- draw the bending moment diagram

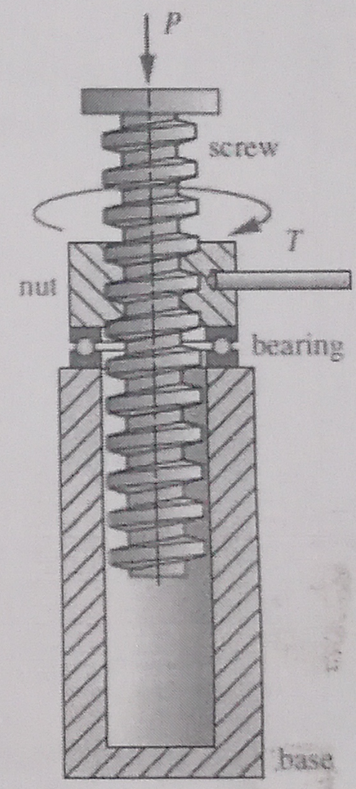
b- determine the fatigue factor of safety



Final Exam: Engineering design

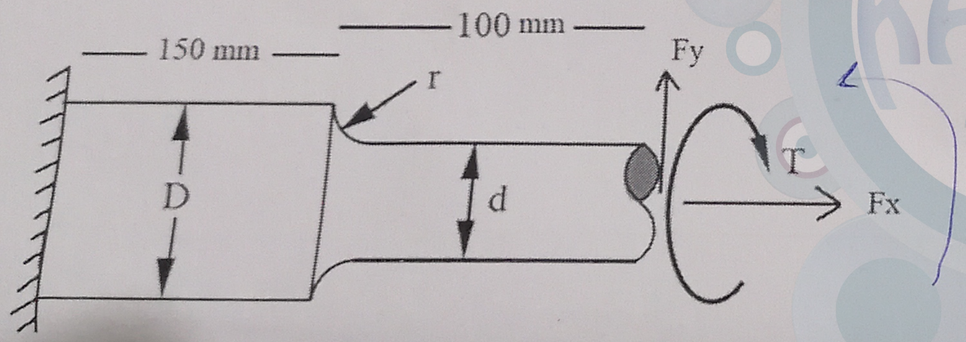
Q1(16P). A square threaded power screw with double thread is shown in the figure below is used to raise a load P=5200 N. The screw has a major diameter d=25 mm and a pitch =5mm. The screw material is steel dry and the nut material is Bronze. The collar diameter is dc=48 mm. The collar material pair used is hard steel on cast iron. Determine:

a- the pitch diameter, root diameter and helix angle.
b- the lifting and lowering torques
c- if the power screw is self locking or not
d-find the Von misses stress



Q2(14P). The round shaft with a shoulder fillet is loaded as shown. The shaft is made of AISI 1040 hot rolled steel. For the critical stress element, determine:

a- the principal stresses and the maximum shear stress
b- the factor of safety, according to Tresca,



T = 8 N.m

Fx = 1200 N

Fy = 120 N

D = 12 mm

d = 10 mm

r = 1.5 mm