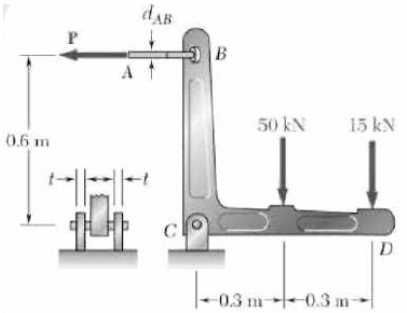
Exam 1
March 27, 2012
60 minutes

Problem 1 (35 Points)

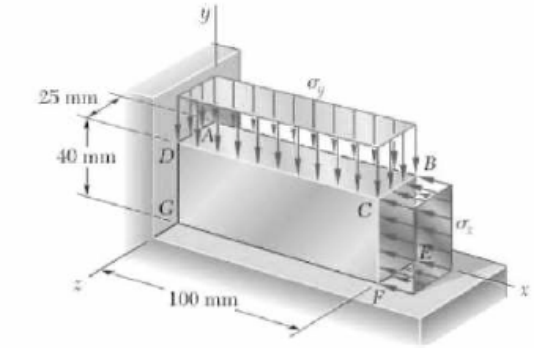
Two forces are applied to bracket BCD as shown. All system components are made of steel with an ultimate normal stress of 600 MPa and an ultimate shearing stress of 350 MPa.

(a) Determine the required diameter of the rod AB for which the factor of safety with respect to failure will be 3.3.
(b) Determine the diameter of pin C for which the factor of safety with respect to failure will be 3.3.
(c) Determine the required thickness, t, of the bracket supports at C knowing that the allowable bearing stress of the steel used is 300 MPa.



Problem 2 (35 Points)

The block shown is made of a magnesium alloy for which E = 45 GPa and ν = 0.35. Knowing that σ_x= -180 MPa and σ_z = 0; determine (a) the magnitude of σ_y for which the change of height of the block will be zero, (b) the corresponding change in the area of the face ABCD, (c) the corresponding change in the volume of the block.



Problem 3 (30 Points)

The length of the 2-mm diameter steel wire CD has been adjusted so that with no load applied, a gap of 1.5 mm exists between the end B of the rigid beam AB and a contact point E. Knowing that E = 200 GPa and that the wire will remain elastic, determine where a 20-Kg block should be placed on the beam in order to cause contact between B and E.