Student ID _____

Department of Mechanical Engineering
Michigan State University
East Lansing, Michigan

Ph.D. Qualifying Exam in Solid & Structural Mechanics

- Closed Book, but one sheet (8.5" x 11", front and back) of your own notes with equations permitted.
- Answer all Questions.
- All questions have the same weighting

Exam prepared by:

Professor P. Kwon
Professor A. Loos

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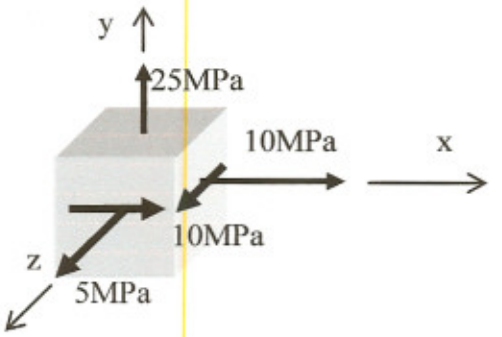
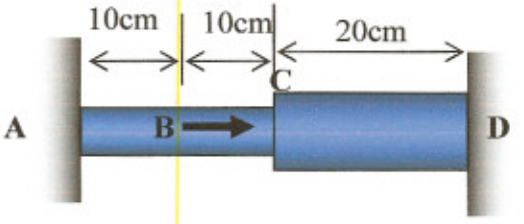
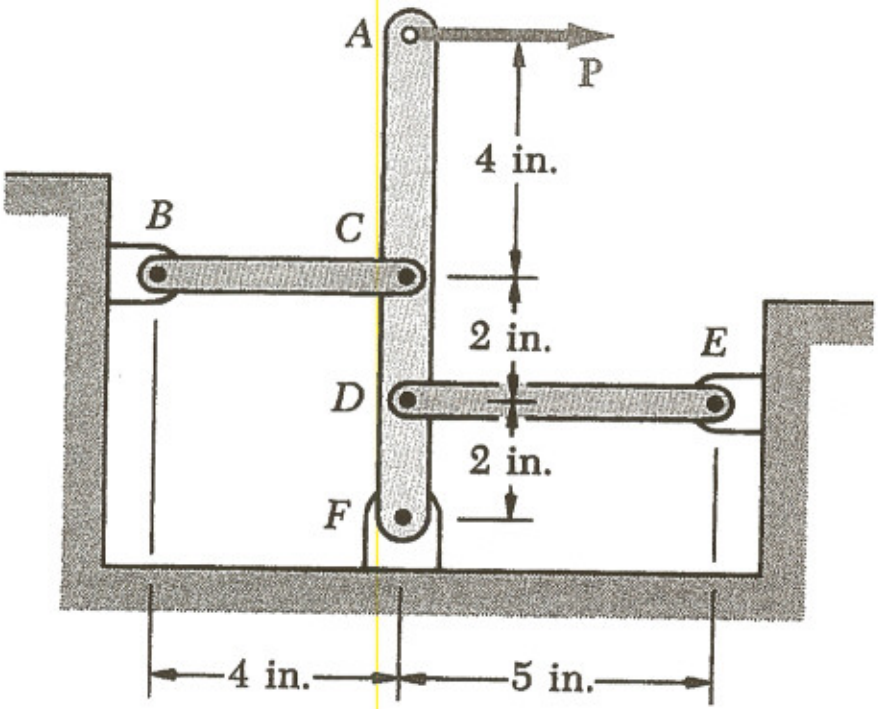
1. (a) Draw the 3-D Mohr circle for the stresses on the element shown below. (b) Determine the maximum in-plane stress and the absolute maximum shear stress, (c) Determine three principal stresses, and (d) With E=25GPa and v=0.3, convert the stress Mohr circle into the strain Mohr Circle. (Use G=E/2(1+v) if needed)



2. The two-section bar is fastened between two rigid walls. The load of 35kN is applied at B. The cross-sectional area of both Section AB and BC is 500mm^2 and that of Section CD is 1000mm^2. (a0 Determine the reaction forces in AB, BC and CD, (b) Determine the stresses in Section AB, BC and CD. (c) Determine the displacement C respect to D. The elastic modulus of the material that the bar is made of is 200GPa



1. Link *BC* and *DE* are both made of steel ($E = 29 \times 10^6$ psi) and are ½ in. wide and ¼ in. thick. Determine (a) the force in each link when a 600-lb force **P** is applied to the rigid member *AF* as shown and (b) the corresponding deflection of point A.



2. Determine the allowable uniformly distributed load w for the beam shown, knowing that $\sigma_{all} = +70$ MPa in tension, $\sigma_{all} = -130$ MPa in compression, and $\tau_{all} = 60$ MPa.