**Solid & Structural Mechanics**

Qualifying Examination

2017

Closed Book & Notes,

May bring one 8**½**x11” page with one side of the page only

1. The beams shown have cross section properties IAB and ICD (I is the moment of inertia in the relevant plane). They are made of the same material. Supports at A and B are simple supports. Beam CD is clamped at C. What are the reactions at A, B and C?



2. The steel pipe has outside diameter d0 =1.6 in and inside diameter di =1.4 in. Use the Von Mises (equivalent) stress criterion to estimate the safety factor. The material has a yield strength of S=29 kpsi and it applies equally in tension and in compression. Assume the pipe fails first and ignore shear due to bending.



3. The stress state given below is in a plane stress condition. (1) Determine the principal stresses and the maximum in-plane shear stress. (2) Determine the factor of safety given that the yield strength is 100MPa using Tresca criterion. Now the strain gage is put at 45**°** as shown on the stress element. (3) Determine the reading on the strain gage with E=30GPa and v=0.3.

30MPa

10MPa

10MPa

4. The torsion bar shown below is constructed with two different size round bars with the radius of a bar AB, cAB=6cm and the radius of a bar BC cBC=4cm. (1) Determine the shear stresses in AB and BC due to the torsion loads given below and (2) Given that G=50GPa, determine the angles of twist at C respect to B as well as respect to A.

200N•m

A

B

C

200N•m

1m

1m