Student Code Number:_____

Ph.D. Qualifying Exam

Intermediate Solid Mechanics
Fall 2009

Prof. Ronald Averill
Prof. Alfred Loos

Directions: One page of notes (8.5 x 11 sheet)

Answer all four questions

All questions have equal weight

Time: 3.0 hrs.

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- Take any required property from your book, approximate values if necessary.
- If you make any assumption to reach a solution state it clearly

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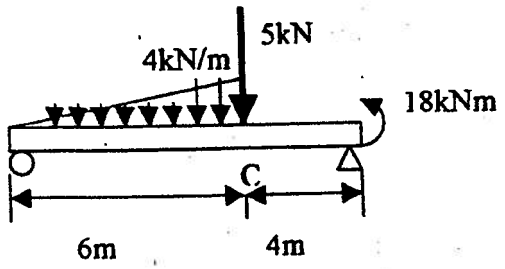
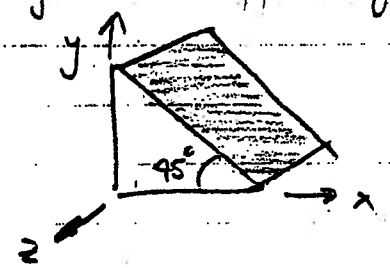
(1) Use Castigliano's theorem to determine the vertical displacement of point C of the steel beam shown below. E= 200GPa. $I=125\times10^{-6}m^4$



3) The state of stress with respect to x, y, z axes is given by

$$\underline{\sigma} = \begin{bmatrix} -20 & 0 & 0 \\ 0 & 30 & 40 \\ 0 & 40 & -10 \end{bmatrix}.$$

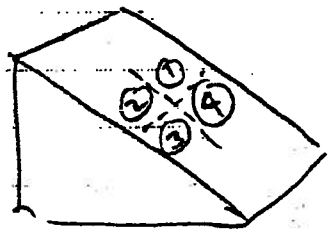
For the surface



What is the normal stress and is it tensile or compressive?

What is the magnitude of the shear stress?

In what quadrant on the surface does the shear stress point?



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The octahedral shear theory states that yielding begins when the actual octahedral shear stress reaches a critical value k, which is found from the one-dimensional tensile test, as was done for the maximum shear theory. Develop the yield condition for the octahedral shear theory and compare it with the yield conditions for the maximum shear theory.