Student Code Number: _____

Ph.D. Qualifying Exam

SOLIDS & STRUCTURAL MECHANICS

FALL 2012

Prof. D. Liu
Prof. X. Xiao

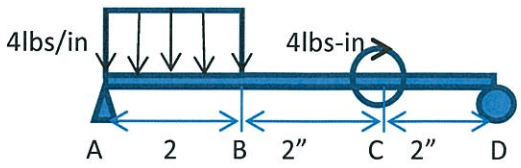
Directions: Open book, only 1 book allowed.

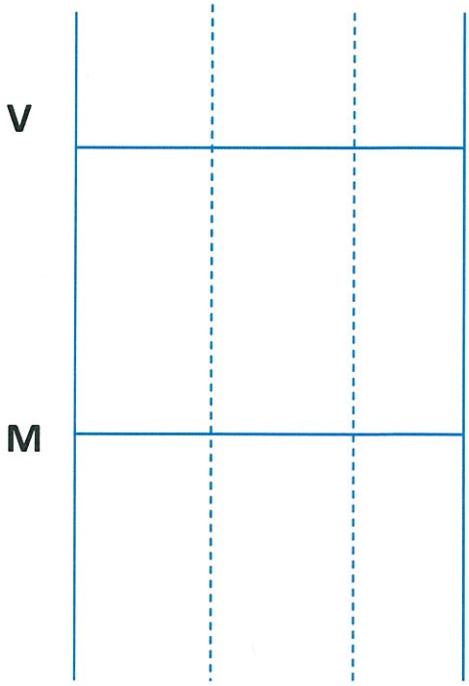
Answer all four questions

All questions have equal weight

Time: 3.0 hrs.

1. Draw shear-force and bending-moment diagrams for the following loaded beam. Identify maximum and minimum values on the diagrams.



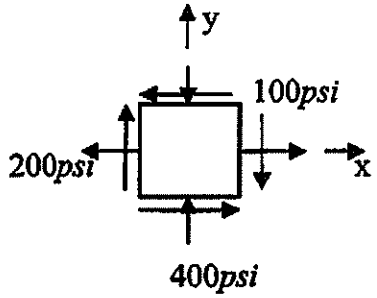


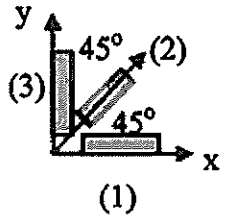
FBD

R_A _____ R_D_____

V	**M**
A:	A:
B:	B:
C:	C:
D:	D:

2. Show below is a stress element in a structure. A three-element strain rosette is also installed at the "point". What are the readings of gage elements (1), (2) and (3) which are oriented along x-axis, 45° from x-axis and along y-axis, respectively? The structure is made of a material with a Young's modulus equal to 10^7psi and a Poisson's ratio 0.25.





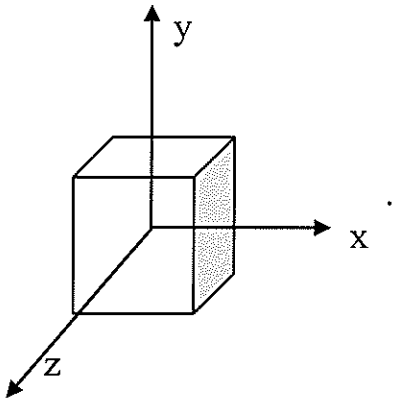
(A) Express the three stress components

(B) Find the corresponding strain components based on the two-dimensional Hooke's law.

(C) Identify the strains measured by the three gage elements with transformation equations.

Part 2

3. These stresses are acting on the cube: $\sigma_x = 5MPa$, $\sigma_y = 10MPa$, $\tau_{xy} = -6MPa$, $\sigma_z = -4MPa$. (a) Indicate the stress components on the cube. (b) Determine the principle stresses and maximum shear stress.



(4) For the prismatic beam and loading shown, determine the magnitude and the location of the largest downward deflection.