Name.....Student I.D.....

Department of Mining and Materials Engineering

Faculty of Engineering

Prince of Songkla University

Mid-term Exam for Semester: 2 Academic Year: 2005

Date: December 12, 2005 Time: 13.30-16.30

Subject: 237-221 Mechanical Metallurgy Room: A401

Instruction

1. There are 3 problem sets. Please do all of them and write your answers on the space provided after each problem set. If you need more space, you can write on the back of paper.
2. Text books and other studying materials are not allowed.
3. Dictionary, calculator, and stationery are allowed.
4. This mid-term exam is accounted for 20% of the total grade point.

Dr. Thawatchai Plookphol

Problem No.	Full Score (points)	Student's Score (points)
1.	30	
2.	30	
3.	40	
Total	100	

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1. A tensile specimen made of 7075-T651 aluminum alloy with gage length of 30 mm and diameter of 6 mm is loaded with a 3000 N force. If the diameter of specimen decreases to 5.9 mm, compute the followings:
   (a) The final length of the specimen (state any assumption you may make) (10 points)
   (b) The engineering stress and engineering strain at this load (10 points)
   (c) The true stress and true strain at this load (10 points)

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2. The following two-dimensional state of stresses is applied relative to an x-y coordinate system:

$$\sigma_{ij} = \begin{bmatrix} 200 & 50 \\ 50 & -100 \end{bmatrix} \text{ MPa}$$

(a) Calculate the principal normal stresses and their orientations. (15 points)

(b) Determine the maximum shear stress and the orientation of the plane on which it operates with respect to the x-y system. (10 points)

(c) Construct a Mohr's circle of stress for this two-dimensional state of stresses. (5 points)

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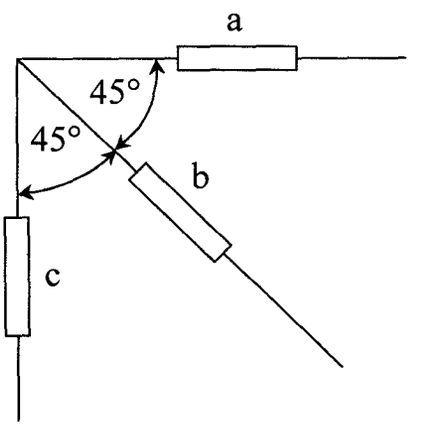
3. In a nylon part ($E = 2$ GPa, $\nu = 0.35$), the normal strains at a free surface are measured along the three directions as shown below:



$$\varepsilon_a = 0.1\times10^{-3}$$
$$\varepsilon_b = -0.2\times10^{-3}$$
$$\varepsilon_c = 0.4\times10^{-3}$$

(a) Draw a Mohr's circle of strains (25 points)
(b) Determine the principal strains and their directions (10 points);
(c) Examine the magnitude of the greatest shear strain (5 points).