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

Department of Mining and Materials Engineering

Faculty of Engineering

Prince of Songkla University

Mid-term Exam for Semester: 1 Academic Year: 2012

Date: July 30, 2012 Time: 9.00-12.00

Subject: 237-502, 238-502 Adv. Mat. Proc. and Mat. Select. Room: A201

Instructions

1. There are 4 problem sets. Please do all of them. Write your answers in the space provided.
2. Textbook and course notes are not allowed.
3. Dictionary and calculator are allowed.
4. This mid-term exam is accounted for 25 % of total grade of this course.

Asst. Prof. Dr. Thawatchai Plookphol

Problem No.	Full Score (points)	Student's Score (points)
1.	15	
2.	10	
3.	20	
4.	30	
Total	75	

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Problem 1 (15 points)

Explain the three basic stages in design process; identify main activities which are performed in each stages of the design process and how does the materials selection involve in each stages of the design process.

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Problem 2 (10 points)

2.1 What is the Ashby's material index (M)? (5 points)

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2.2 What is materials selection chart? (5 points)

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Problem 3 (20 points)

Use the Modulus-Strength chart below to identify a subset of materials may be used for making elastic seal with

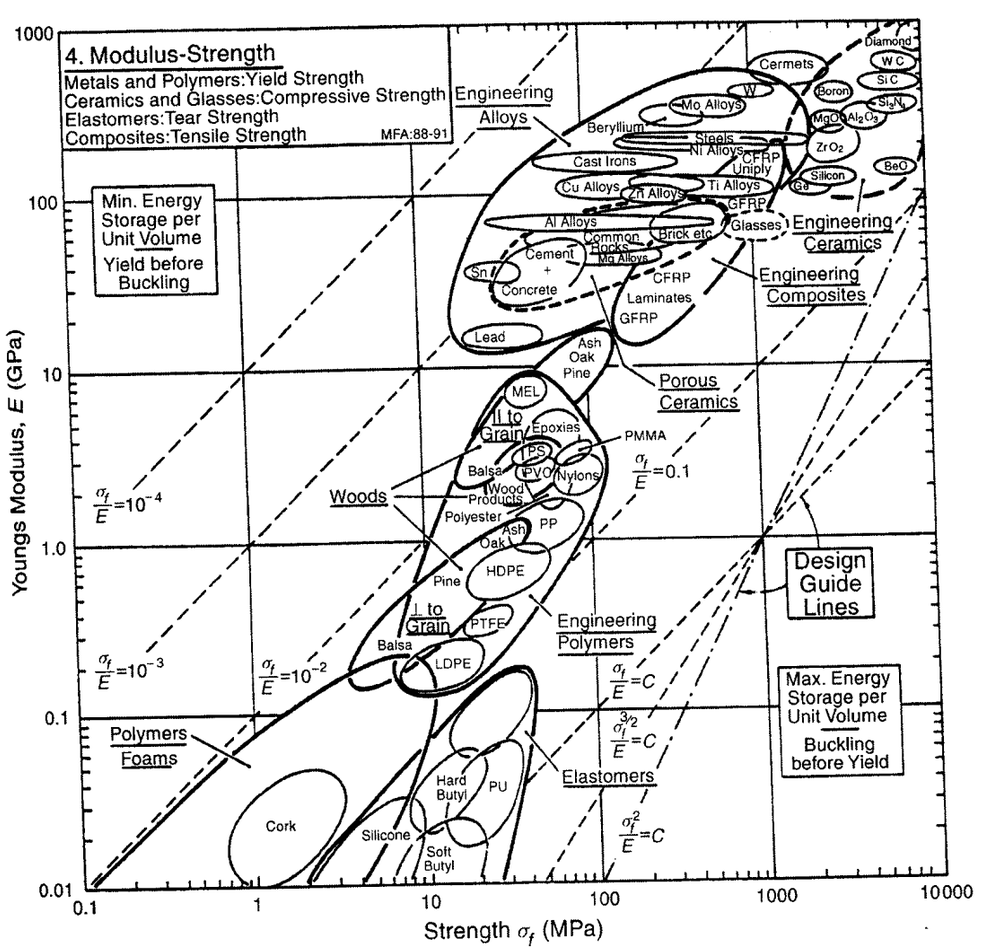
$$M_1 = \frac{\sigma_f}{E} = 0.05$$

$$M_2 = \sigma_f \leq 100 \text{ MPa}$$

3.1 Draw M_1 and M_2 selection lines on the chart (10 points)

3.2 Label the search region on the chart (5 points)

3.2 Identify three materials from the search region (5 points)



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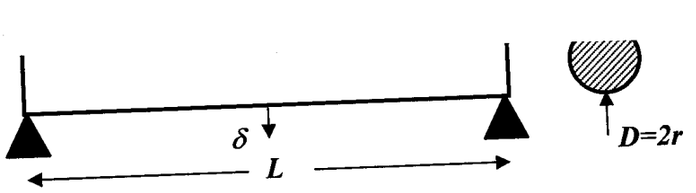

Given:

$$S = \frac{F}{\delta} \geq \frac{48EI}{L^3}$$

$$I = \frac{\pi r^4}{}$$

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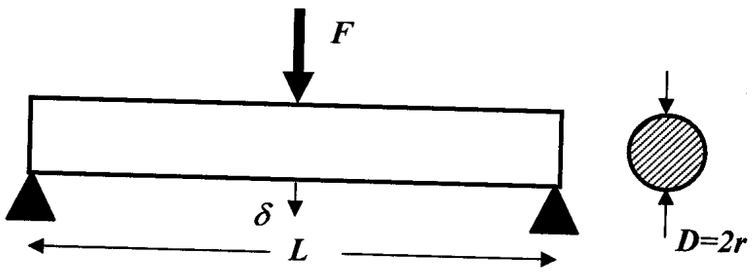
Problem 4 (30 points)

Derive material index M for a light, stiff beam having length L with solid circular cross-sectional area. The diameter D of beam is not specified (i.e. D is free). The beam must support a bending load F without deflecting too much, meaning that the bending stiffness S is specified.

Please show that $$M = \frac{E^{1/2}}{\rho}$$



Given:

$$S = \frac{F}{\delta} \geq \frac{48EI}{L^3}$$

$$I = \frac{\pi r^4}{4}$$

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