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: 2013

Date: July 30, 2013   Time: 9.00-12.00

Subject: 237-405 Materials and Process Selection   Room: Robot

Instructions

1. There are 3 problem sets (7 pages including cover). Please do all of them.
   Write your answers in the space provided.
2. Text books 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.	30	
2.	40	
3.	30	
Total	100	

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Problem 1 Explain the following terms:

    1.1 Conceptual design (5 points)

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    1.2 Embodiment design (5 points)

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    1.3 Detail design (5 points)

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1.4 Design requirements translation (5 points)

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1.5 Materials performance index, *M.* (5 points)

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1.6 Material selection chart or Ashby's chart. (5 points)

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Problem 2 (40 points)

2.1 Derive material index, M for a cheap and stiff table leg which can be assumed as a simple column. The table leg must be solid circular section with height, H and support a compressive load, F without buckling. The section area, A of the table leg is free for choosing. The elastic buckling load F_{crit} is given by

$$F_{crit} = \frac{n\pi^n EI}{H^2}$$

where n is a constant that depends on the end constrains and

$I = \frac{\pi r^4}{4} = \frac{A^2}{4\pi}$ is the second moment of area of the column.

2.2 What is the materials selection chart which can be used for this problem?

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Problem 3 (30 points)

Use the Young's modulus-relative cost chart to identify materials with

$$M_1 = E > 100 \qquad \text{GPa}$$

and

$$M_2 = \frac{E^{1/2}}{C_{v,R}} > 10 \qquad (\text{GPa})^{1/2}$$

3.1 Draw the selection line M_1 on the chart (5 points)
3.2 Find the slope of line M_2 (5 points)
3.3 Draw the selection line M_2 on the chart (10 points)
3.4 Label the selection region on the chart (5 points)
3.5 Identify the materials (5 points)