University of Toronto
Faculty of Applied Science and Engineering
APS111H1S - Engineering Strategies and Practice I
Course Instructor: Mr. Jason Grenier
Communication Instructor: Dr. Maria Cioni
Final Examination

April 25th, 2013
9:30am – 12:00pm

Full Name: _____

Student Number: _____

Final Examination Instructions

1. This is a Type A: Closed book examination, no aids permitted.
2. Ensure that you have all 12 pages of this final exam.
3. You have 2 hours and 30 minutes to complete this exam.
4. Read each question carefully and answer in the space provided.
5. Marks for each question are indicated in square brackets [ ].
6. **All questions must be answered in full sentence/paragraph structure using good engineering writing.**
7. Attempt all questions in the space provided.
8. Question 8 is the only question that is to be completed in the exam booklet.

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Total
___/12	___/6	___/12	___/5	___/18	___/15	___/7	___/50	___/125

Question 1: [12 Marks] Clearly circle TRUE or FALSE in response to each statement. If the answer is false then you must explain why it is false by giving the correct answer.

[TRUE or FALSE]: Design for Environment includes the principle of "cradle-to-cradle".

[TRUE or FALSE]: The Service Environment describes the design's operation.

[TRUE or FALSE]: Every communication assignment should begin with an introduction.

[TRUE or FALSE]: The PEO Code of Ethics states that the following an Engineer's duty is first and foremost to his/her client.

[TRUE or FALSE]: The Human-tech approach to design requires that humans should adapt to accommodate technology

[TRUE or FALSE]: The steps of a life-cycle assessment are done in the following order: Impact analysis, Inventory analysis, Improvement analysis

[TRUE or FALSE]: Weighted decision matrices are used to compare functions to objectives

[TRUE or FALSE]: Final costs are also known as decommissioning costs

[TRUE or FALSE]: Engineering is a self-regulated profession

[TRUE or FALSE]: Human Tech and Industrial Ecology are systems approaches in engineering design.

[TRUE or FALSE]: The Iron Ring represents a Professional Engineering license

[TRUE or FALSE]: In a pairwise comparison, each objective is compared with a constraint.

Question 2 [6 Marks]
Tables 1 contain a Weighted Decision Matrix for a design project. Analyze the results and answer the following questions:

(a) Which design, would you recommend to the client at this time? Justify your answer.
(b) What could you suggest to the design team as possible feedback for another design iteration?

Table 1: Weighted Decision Making Matrix

Constraints	Design #1	Design #2	Design #3	Design #4
C1	o.k.	o.k.	o.k.	fail
C2	o.k.	o.k.	o.k.	o.k.
C3	o.k.	o.k.	o.k.	o.k.
Objectives				
O1	.35 × .60 = 21%	.35 × .05 = 1.75%	.35 × .05 = 1.75%	.35 × .90 = 31.5%
O2	.30 × .60 = 14%	.30 × .80 = 24%	.30 × .90 = 27%	.30 × .90 = 27%
O3	.20 × .70 = 18%	.20 × .90 = 18%	.20 × .20 = 4.0%	.20 × .20 = 4.0%
O4	.10 × .30 = 3%	.10 × .90 = 9.0%	.10 × .05 = 0.5%	.10 × .05 = 0.5%
O5	.05 × .05 = 0.25%	.05 × .90 = 4.5.0%	.05 × .25 = 1.25%	.05 × .25 = 1.25%
Totals	56.3%	57.3%	34.5%	64.25%

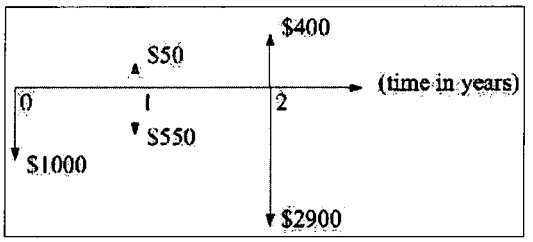
Question 3: [12 marks]

(a) The cash flow diagrams for two alternative designs are shown below. Considering only the economic impact, which of the two alternatives would you recommend to your client and state your justification. Note that your client is able to invest their money at an annual compounded interest rate of 25%. For full marks a fully justified explanation along with a numerical analysis is required. (6 marks)

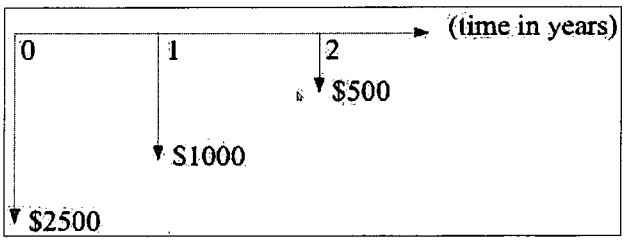
Hint 1: The following formula may prove helpful in solving this problem: $PV = FV\left(\frac{1}{1+r}\right)^t$

Hint 2: Use fractions to avoid the need for a calculator

Alternative Design 1



Alternative Design 2



(b) In part (a) you made a recommendation based only on the economic factors. What are some other factors that design teams should consider when making a recommendation to their clients? Justify your choices. (3 marks)

(c) What is meant by the 'time value of money'? Given an example. (3 Marks)

Question 4: [5 marks]
Recently, Ontario brought in a law which bans the use of handheld devices while driving, e.g., no talking on cell phone hand sets or operating of MP3 and GPS devices while driving. This law was enacted in an effort to improve road safety.

(a) At the physical level of Vicente's Human-tech ladder, explain how this law may improve road safety? (2 marks)

(b) However, drivers are still allowed to use hands-free devices while driving, e.g., talk on the phone using a Bluetooth headset. At the psychological level of the Human-tech ladder, explain how this law may not improve road safety? (2 marks)

(c) Creating a law (as in this case) would be an example of which level of the Human-tech ladder? (1 mark)

Question 5: [18 marks]

(a) A design team has come up with 40 design alternatives. Describe the techniques and process that a design team would use to arrive at a single design to recommend to the client. (5 Marks)

(b) Identify and explain the three types of costs considered during the engineering design process (6 Marks)

(c) Which Act governs the engineering profession in Ontario? (2 Marks)

(d) Who is the governing body for engineers working in Ontario? (2 Marks)

(e) What are three distinct licensing requirements to become a licensed Professional Engineer in the Province of Ontario? (3 Marks)

Question 6: [15 marks]

(a) In your own words, explain what is "engineering design," and include the relationship of engineering design with communication and team work. (5 marks)

(b) Give two detailed examples of how you applied critical thinking in the course. (4 Marks)

(c) Identify the three parts of the communication triangle and explain how each of them influence your communication. (6 Marks)

Question 7: [7 marks]

(a) According to Charlie's presentation on PRODIGI fluorescence imaging for wound care, state 1 objective and explain why it is good objective for the design. (2 marks)

(b) According to Charlie's presentation on PRODIGI fluorescence imaging for wound care, state 1 constraint and explain why it is good constraint for the design. (2 marks)

(c) According to Charlie's presentation on PRODIGI fluorescence imaging for wound care, list 2 stakeholders, state their interest and explain what how their interest will impact the design. (3 marks)

Question 8: [50 Marks Total]
Read the client statement below and answer the related questions in the exam booklet using headings, subheadings, paragraphs, bullet lists, and labeled figures and tables where appropriate.

Client Statement:
Primo Pizza is located on the main floor of an historic building in downtown Toronto. There are 6 apartments on the two floors above the pizzeria. This is the only restaurant in the city that has a hand-made, 5,000-pound pizza oven made in Naples, Italy. This wood-fired oven produces an extremely high heat, 900 degrees Centigrade, to cook the dough in 90 seconds with the desired charred, blistered crust. While the oven heat warms the place in winter, in the summer the staff and customers feel they are in a steam bath. The unbearable heat reduces appetites and the number of sit-in customers. The owner wants lots of customers year round, especially those that stay in the restaurant to eat.

Since the special oven is a main attraction, the kitchen is open and situated in the middle of the seating area that holds 40 people. Another 10 people can sit at the long bar which runs parallel to the large glass windows at the front of the restaurant. When the restaurant opens at 5 p.m., young and old families come and later at night, singles, couples, larger groups and after-movie crowds eat until closing at 1 a.m.

The restaurant owner is environmentally aware and is conscious of his impact on the environment. The restaurant uses green electricity, a mixture of emission-free wind power and low-impact water power. Since the pizza oven has cost so much money, the owner's budget to cool the restaurant is $1,000 maximum and would be interested in lower cost designs. Finally, the restaurant would prefer that the solution be implemented prior to June 1st when the business picks up but can wait as long as July 1st of this year before the really hot weather starts.

In the exam booklet address the following questions:
8.1) Complete the Project Requirements section of the Conception Design Specifications
-Write a concise Problem Statement in your own words [5 marks]
-Identify 3 stakeholders, their concerns with the project, and the impact it will have on the design [6 marks]
-Formulate functions for the design (all relevant aspects) [3 marks]
-Formulate 3 objectives (include goals as well) [6 marks]
-Rank your objectives using a Pairwise Comparison Chart [3 marks]
-Formulate at least 2 constraints [3 marks]

8.2) Generate and describe two **feasible** design alternatives (include a labeled sketch) [6 marks]
8.3) Use a Weighted Decision-making Matrix to recommend one of the your two design alternatives [4 marks]
8.4) Design a metric for your top-ranked objective [3 marks]
8.5) Discuss the Economic Impact of your recommended design (Hint 3 types of costs) [4 marks]
8.6) Discuss the Environmental Impact of your recommended design (a life-cycle diagram is not required but you should do an inventory, impact and improvement analysis) [4 marks]
8.7) If the service environment had been the basement level of Eaton Centre Shopping Mall, how might the Project Requirements have changed? (3 marks)

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