

Name: \_\_\_\_\_ Student Number: \_\_\_\_\_

UNIVERSITY OF TORONTO

FACULTY OF APPLIED SCIENCE AND ENGINEERING

APS111TH1S: ENGINEERING STRATEGIES AND PRACTICE I

COURSE INSTRUCTORS: IVEY CHIU AND DARIO DEL DEGAN

FINAL EXAMINATION

April 25, 2008

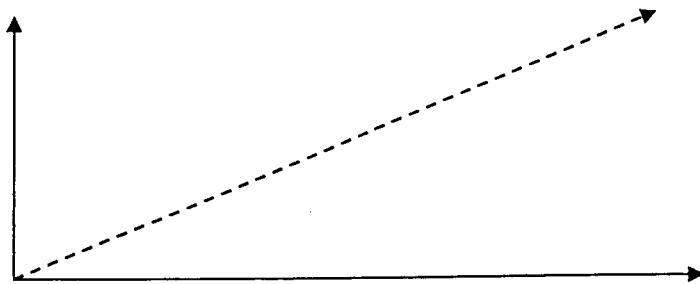
Calculator Type: Type 3

Exam Type: Type A

The time allocation for this final exam is 2.5 hours consisting of Part A: Team Development and Engineering Design, and Part B: Engineering Communications. Answer all questions in the space provided. Do not write on the back of the page. Exam booklets will be provided as scrap paper for rough work ONLY. Please be sure your answers are clear and legible. Please write all answers in dark ink. Use a strike-through line to indicate a correction (E.g. ~~This is what how to indicate a correction in your written answers~~). This is a closed book exam. Only calculators from the list of those approved by the faculty are allowed. No other aids are permitted.

**Part A: Team Development and Engineering Design [80]**

1. For the team development model below, label the axes, and explain the significance of the arrow [3].



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2. Using the stages of the modified Dym & Little model of design applicable to APS 111, briefly describe the purpose of the stage, the inputs to the stage, a method associated with the stage, and the outputs [9].
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3. a) For Design X, there are 3 objectives and 2 constraints. The objectives are not equally important and it can be assumed that objective 1 is relatively more important than objective 3. There are 4 alternatives. Complete the set up of the weighted decision matrix given below. Do NOT calculate the final results [6].

Design Criteria	Weight	

b) If the total for the first alternative is 5.9, and the total for the third alternative is 6.0, would you automatically select the third alternative? [1]

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c) Give the mathematical expression(s) for calculating the totals for each alternative [2].

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4. Some citizen groups are calling for a law to ban drivers from using cell phone handsets when they are driving. Using Vicente's Human-tech ladder, identify the level at which this proposed legislation will originate. Also identify the levels at which it will affect the individual driver.

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5. What are the four steps of life cycle analysis? [4]

1. \_\_\_\_\_  
2. \_\_\_\_\_  
3. \_\_\_\_\_  
4. \_\_\_\_\_

6. List the four ways you can reduce the residuals in your design from the start of the design process [4].

1. \_\_\_\_\_  
2. \_\_\_\_\_  
3. \_\_\_\_\_  
4. \_\_\_\_\_

7. What are three advantages for reducing residuals? [3]

1. \_\_\_\_\_  
2. \_\_\_\_\_  
3. \_\_\_\_\_

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8. Write out the equation for determining True Profit and explain each term [4].

9. Distinguish between operating costs and capital costs. Give two examples of each type of cost with correct units [4].

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10. Briefly explain the concept of "time value of money" [1].

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11. Explain how you can compare \$X that you spend today, versus the same \$X you will spend Y years from now. Do not use any equations [2].

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12. What is the difference, in today's dollars, between spending \$100 today, and spending \$100 two years from now? Assume an annual compounded discount rate of 10%. Provide your answer to the nearest cent. Show all your steps and briefly define all the terms in any equation you may choose to use [4].

13. Your friend is about to graduate from Mechanical Engineering at the University of Toronto. She did a Professional Experience Year placement after her third year and will have been at UofT for a total of 5 years. She received her Iron Ring about a month ago. You have noticed that on her resume, she has added the title "P. Eng." after her name. Explain why or why not she can call herself a P.Eng. at this point [4].

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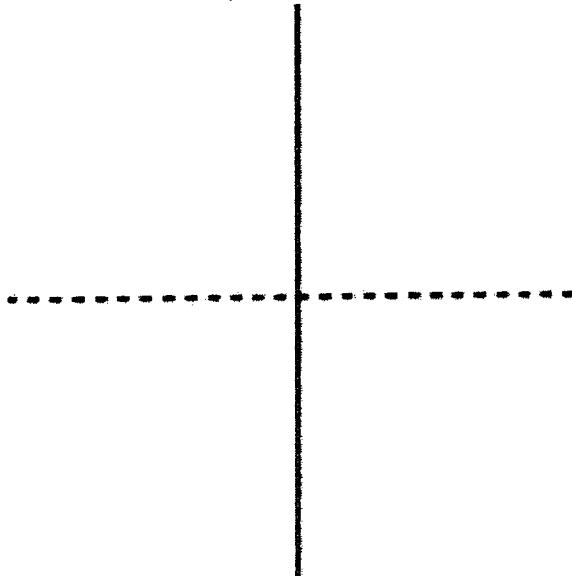
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14. According to the PEO, what are the 6 defining tasks of engineers? [3]

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_

15. Label the quadrants and axes of the Ethics/Law matrix below. Indicate the quadrant in which you would want to operate as an engineer [2].



16. Explain why one line in the matrix is solid, and why the other one is dotted [2].

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17. You are an engineer and the owner of a company that makes water purification products. You realize that your research and development staff may have discovered a revolutionary water purification method that could save many lives in countries without adequate drinking water. However, you decide that it would cost your company too much money to further develop this technology. Furthermore, there is no market for this technology in Canada. As a result you discontinue this project. Using the Ethics/Law matrix, comment on this action. Is this situation common or unique? [2]

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18. William LeMessurier is a structural engineer known for innovative designs, such as the Citicorp Center. In the case study discussed in class, and in Dym & Little, describe LeMessurier's ethical dilemma, and his ultimate decision and action. What might have been the consequences had LeMessurier made a different decision? [4]

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19. Did LeMesseurier's ultimate decision and action agree with the PEO Code of Ethics? Why or why not? [2]

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20. What are the two basic types of law and who/what creates them? [2]

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21. Write the "equation" that defines a contract and explain each term [3].

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22. Name and briefly describe two types of contracts [4].

1.

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2.

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23. What is liability? [1]

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### **Part B: Engineering Communications [40]**

1. Identify and explain the purpose of 3 of the 8 ESP Communication Goals [6]:

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2. Write a credible statement regarding the evolution of memory devices based on the information below. Remember that a "credible statement" does not necessarily have to be formulated in one sentence [3].

The growing market for small memory devices with increasing capacity can be seen in the history of SanDisk Corporation. A year after the company was founded in 1988, it filed its first patent for a portable memory device. By 1990, SanDisk was manufacturing a 4mbit flash chip. Revenues in 1992 were \$22 million. By 2004, flash stick capacity had grown to 4 gigabit, revenues to \$1.8 billion (<http://www.sandisk.com/Corporate/About/>).

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3. Identify and describe the 5 stages of the writing process [2].

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4. Formulate a Compound/Complex sentence based on the information below [2]:

- DAI manufactures toys for children.
- DAI desires to expand its market.
- The Sales Director at DAI feels the company has exhausted the possibilities for children's toys.

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5. Write the bibliographic entry for the following journal article. Number the reference as your first. Make sure your punctuation is accurate [1].

Authors: Haijun Yang

Title: Continuous bio-hydration production from citric acid wastewater via facultative anaerobic bacteria

Journal: International Journal of Hydrogen Energy

Volume: 31

Number: 3

Pages: 1306 to 1313

Year: 2006

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6. Describe the difference in meaning between "its" and "it's" and identify which one you would avoid when writing formal reports such as a Conceptual Design document [2].

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7. Describe the differences between a paragraph and a bullet list and give an example of an appropriate use for each in the Conceptual Design Specification [4].

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8. a) The following paragraphs contain at least 10 writing errors/problems. Identify five of the errors by circling each error and labeling the errors 1 through 5 [5].

Based on a results from the evaluation of objectives and the consultation with the client (please see decision making processes in Appendix B for pair-wise comparisons and morphological charts) we decide that the best possible solution for Tyndale is to replace a number of static shelves in the library's basement. The design had called for replacing 2 quadrants in the library basement with compact shelves (refer to Appendix A for library layout). Contacted many Canadian based storage companies, and the company that gave us the most useful feedbacks are SpaceSaver a branch from Montel (an internationally known shelving organization (MTM)) based in Aurora who has actually worked with Tyndale in the past.

According to the datum, each of the regular doubled-sided shelves (Appendix A, figure 4) in the library's basement currently stores approximately 2100 books on average. We estimated the average weight of a book to be 2 1/2 lbs, thereby making the total amount of books in each double-sided shelf approximately 23353 N. Since Tyndale despeartely desires to expand it's collection by 5200 books per year for the next three years (a total of 15600 books approximately, occupying about 2016 of the library space ft<sup>3</sup> of the library space), it will require approximately 8 regular static doubled-sided shelves to allow for the minimum expansion required. However, it's likely that the library may expand the collection by more then the minimum required amount. Currently their is no free space in the library to insert any static shelves without compromising the area of the workspace or book accessibility, which are both implausible. The installation of a compact shelves typically reduced the space needed by 50% [1], therefore the best solution to the problem would be to replace some existing static shelves with compact shelving units. This solution will liberate Tyndale library from its space constraints with a new and improved look that preserves the historic character of the workspace without infringing on existing storage units.

- b) Fix each of the errors you identified with proper sentences [5].

- i) \_\_\_\_\_
- ii) \_\_\_\_\_
- iii) \_\_\_\_\_
- iv) \_\_\_\_\_
- v) \_\_\_\_\_

9. Write an explanatory report describing the purpose, components, and functions of the Life Cycle and the Social Impact sections in a Conceptual Design Specification. Use the object you selected for seminar presentation as an example to illustrate what information is provided in a Life Cycle and a Social Impact analysis. Your response will be evaluated both on your understanding of the content as well as your writing. Be sure to prepare a well thought out response that includes:
- a) a proper introduction with the outline and purpose of your response
  - b) a thorough explanation of the Life Cycle section of a CDS using your object as an example
  - c) a thorough explanation of the Social Impact section of a CDS using your object as an example
  - d) a clear explanation of the purpose of these sections in a Conceptual Design Specification
  - e) a proper conclusion that summarizes the explanation and re-enforces the importance of these sections to the Conceptual Design Specification

Do not exceed the space provided. [10]

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