Name: _____ Student Number:_____

UNIVERSITY OF TORONTO

FACULTY OF APPLIED SCIENCE AND ENGINEERING

APS111TH1S: ENGINEERING STRATEGIES AND PRACTICE I

COURSE INSTRUCTORS: IVEY CHIU AND AMY WHITTAKER

FINAL EXAMINATION

April 29, 2010

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 for Section 2-Question 5 ONLY. All other attempts to answer questions in the exam booklet will be ignored. 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.

This exam is worth 116 marks. An additional 10 marks will be allocated for correct language use for a total of 116 + 10 = 126 marks.

Name: _____ Student Number: _____

Section 1: Team and Engineering Design [81]

1. a) Any toy advertised, sold, or imported in Canada must meet the safety

    requirements defined in the [1]: _____

    _____

    b) These requirements are administered and enforced by this governmental

    agency [1]:_____

2. Functions are phrased using this type of word _____ ;

    objectives using this word _____ ; and constraints using this

    word _____ . [3]

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

    _____
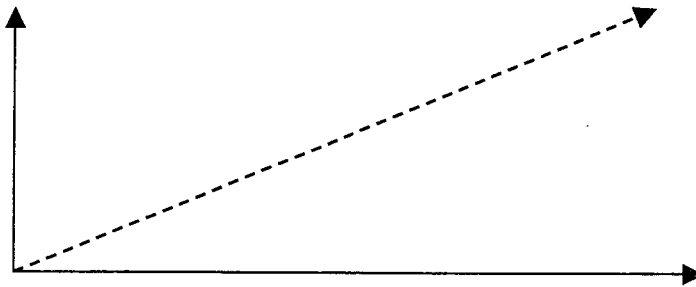
4. a) What is the purpose of the Service Environment section in the CDS and
        what "environments" should it encompass, if relevant? [2]

    _____

    _____

b) In the Canadian Space Agency case study, identify and describe **one** of the five specific challenges engineers face when designing for the space service environment. Give an example [2]:

_____

_____

_____

5. In a 3x3 pairwise comparison, one objective received a "0" score and the other two objectives received a non-zero. Does this mean that the objective with the "0" should be discarded and only the other two considered? Explain [2]:

_____

_____

_____

6. In a weighted decision matrix:

a) How would you calculate the total rating for the second alternative if the second alternative violates the first constraint? [1]

_____

_____

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]

_____

7. a) 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. At the physical level of Vicente's Human-tech ladder, explain how this law may improve road safety [2]:

_____

_____

_____

_____

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]:

_____

_____

_____

_____

c) at what level of the Human-tech ladder does this law originate from? [1]

_____

8. List the four stages of life cycle analysis [4]:

1. _____
2. _____
3. _____
4. _____

9. Identify the steps required in stage 2 of life cycle analysis [3]:

1. _____

2. _____

3. _____

10. Give three reasons why you would want to reduce the residuals, or prevent pollution, in your design [3]:

1. _____

2. _____

3. _____

11. a) Write out the equation for determining True Profit and explain each term. Be sure to differentiate between the different types of costs in the equation and in the expanded terms [4].

b) Who would want to maximize true profit and why [2]?

_____

_____

_____

c) Who would want to maximize the other type of profit and why [2]?

_____

_____

_____

d) Which type of profit do we typically use in our economic decision-making and why [2]?

_____

_____

_____

12. Distinguish between operating costs and capital costs. Give two examples of each type of cost with correct units [2].

_____

_____

_____

_____

13. You know that in Y years from now, you will need to spend $X. You also need to spend the same $X today. What is the difference in terms of the value between $X today and $X, Y years from now? What assumptions do you need to make? Do not use any equations [3]:

_____

_____

_____

_____

14. You are preparing a contract to supply your widgets to a client needing them to complete a project three years from now. You currently sell widgets for $100 each. How much should you charge for your widgets three years from now so that you are maintaining the same value for your product? Assume an annual compounded discount rate of 9%. 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 [6].

15. Your cousin has graduated from a large Ontario university with a CEAB accredited degree in engineering. He received his Iron Ring back in March. During the summers, he worked for an engineering company and is now applying for a full time job with them. You noticed that he added the title "P.Eng." to his resume. Explain why or why not he can call himself a P.Eng. [3]:

_____

_____

_____

16. a) Label the quadrants and axes of the Ethics/Law matrix below. Comment on each of the quadrants, including which quadrant you would want to operate as an engineer [6]:
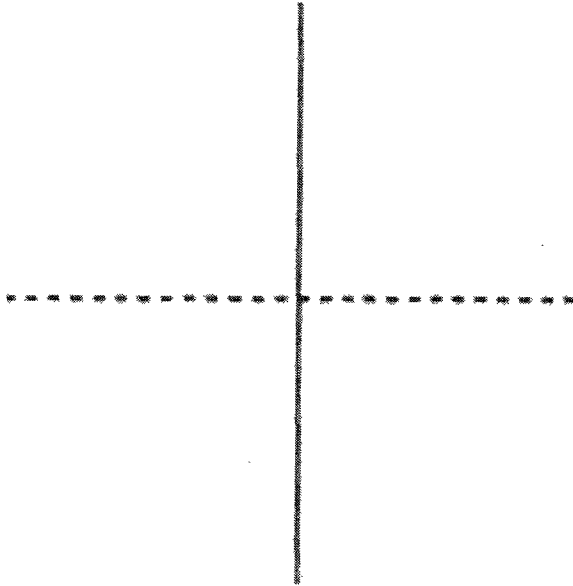
b) Explain why one of the lines in the matrix is solid and why the other one is dotted [2].

_____

_____

17. a) In the ethics case study discussed in class, and in Dym & Little what did LeMessurier design and in what city? [2]

_____

b) Describe two of the innovative features of his design [2]:

_____

_____

_____

_____

c) Describe LeMessurier's ethical dilemma. Using the Law/Ethics matrix, comment on the legality and ethics of his dilemma [4].

_____

_____

_____

_____

_____

_____

_____

_____

d) What were LeMessurier's ultimate decision and actions? What might have been the consequences had LeMessurier decided to make a different decision [2]?

_____

_____

_____

e) Did LeMesseurier's ultimate decision and actions agree with the PEO Code of Ethics? Why or why not? [2]

_____

_____

_____

18. a) What is liability? [1]

_____

b) In what two ways can liability arise? [2]

_____

_____

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

Section 2: Engineering Communications (35 marks total):

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

_____

_____

_____

_____

_____

2. Read the following sentences. Decide whether the words in *italics* are being used correctly. For each sentence, if the word is correct place the letter "C" in the blank at the end of the sentence; if the word is incorrect, write the correction in the blank at the end of the sentence. [5 marks]

Example: John recorded the *cereal* number of his new bicycle. __serial__

Example: The usher was standing in the middle of the *aisle*. ___C___

a) Rheumatic fever can *effect* the heart. _____

b) The CDS draft can be located over by *their* work station. _____

c) The company fired *it's* employees for having substandard communication skills. _____

d) The data set *is* stored on the computer. _____

e) Use a decision making process to determine which ideas are better *then* others.

_____

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

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

_____

_____

_____

_____

4. Formulate a Compound/Complex sentence based on the information below [2 marks]:
- Kong® manufactures toys for dogs.
- Kong® desires to expand its market.
- The sales director at Kong® feels the company has exhausted the possibilities for dogs' toys.

_____

_____

_____

_____

5. Please read the following client statement:

Astral Media seeks to improve the design of the flap and pedal on its most recent model of the garbage bin as designed for the City of Toronto. The current design includes a foot pedal mechanism to open the flaps to the bin's waste slots. The rationale behind the current design is its potential to be more hygienic than the previous SilverBox model. However, the current design exhibits a number of flaws that impact the usability of the bin. These flaws include:
a) A lack of accessibility to users that rely on mobility devices as these users cannot use the foot pedal.
b) Flaps that are difficult to push open due to a spring loaded mechanism, thereby allowing garbage to spill out onto the street.
c) A large amount of force is required to use the pedal.
d) Flaps that do not open wide enough to accommodate large pieces of refuse.
e) A pedal that will not work in all weather conditions.

Once a new design is chosen, it will be piloted on the University of Toronto campus.

Based on the above information, write a problem definition in the ***exam booklet***. The problem definition must include:
A) a problem statement (4-5 sentences)
B) the functions (2), objectives (3) and constraints (3) required for the re-design
C) a list of 5 stakeholders that includes their concern with the re-design
D) a few sentences related to the applicable service environments.
(Total marks: 25)