University of Toronto - Faculty of Applied Science and Engineering
APS111H1S Engineering Strategies and Practice
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Communication Coordinator: Prof. D. Del Degan

Final Examination
April 18, 2006

The exam is 2.5 hours in duration. Answer all questions in the space provided. 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 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 permitted. No other aids are permitted.

Multiple choice questions have only one correct answer. Circle the letter corresponding to the correct answer. No marks will be deducted for incorrect answers and thus you should try to answer all questions.

Student Name: _____

Student No: _____

Summary of Results:

Q#	Question Type	Recommended Time (min)	Potential Score	Actual Score
Q1	Multiple Choice	20	20	
Q2	Short Answer	30	20	
Q3	Q&A Design Project	30	20	
Q4	Various Communications	40	20	
Q5	Long Answer – Presentation	30	20	
TOTAL		2.5 hours	100	

Q1.	Value	Sugg. Time	Purpose
	20/100	20 min	To test basic understanding and knowledge of course material.

Q1-1. The four main stages of Lifecycle Assessment are:

a) Evaluate, Analyze, Identify, Eliminate

b) Identify Scope and Life Cycle, Inventory Analysis, Impact Analysis, Improvement Analysis

c) Identify Potential Problems, Analyze Findings, Analyze Potential Solutions, Implement Findings

d) Identify Life Cycle, Impact Analysis, Improvement Analysis, Implementation Planning

e) Birth, Teen Angst, Middle-Age Boredom, Old-Age Grumpiness

Q1-2. The type of human factors considered in engineering design include:

a) Political and Organizational

b) Psychological

c) Sociological

d) All of the above

e) a and b only

Q1-3. Examples of human factors at the team level (of the *human-tech ladder*) include:

a) Corporate culture and reward structures

b) Staffing levels

c) Authority, roles, and responsibilities

d) All of the above

e) The reasons that the Maple Leafs are not making it to the playoffs this year

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Your client (Dynatec) was very pleased with your conceptual design, and they now want you to design the production line for this new toy idea. You have six months to deliver a detailed design of the production line.

Your client has provided the following estimates:

Economic Factor	Estimate
Sale price (per unit toy) **P**	50.00 USD
Annual sales projections (# units sold) **X**	100,000 units

Answer **Q1-4 – Q1-10** regarding this new project.

Q1-4. "How many employees will be required on this production line" could be considered:

a) An open-ended question
b) A closed-question
c) A point of research
d) Both b and c
e) An unimportant consideration during the design of a production line

Q1-5. Deliverables for this project include:

a) The conceptual design specification
b) The detailed design specification
c) Both a and b
d) A gap analysis of the skills available in the current workers versus the skills needed to run the new production line
e) Both b and d

Q1-6. You have six months to complete this project. This can be considered:

a) The project deadline.
b) A project milestone.
c) The scope of the project.
d) Both a and b.
e) Five months in which to do nothing and one month in which to work frantically.

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Q1-7. Your client did not explicitly ask you to select the make and model of the production line machinery. However, one month into the project, your client insists that you included this work in the project. This could be considered:

a) A missed requirement

b) Scope creep.

c) Both a and b.

d) An objective of the project.

e) Lifecycle analysis.

Q1-8. Your team estimates total internal costs of 3,500,000USD for building the production line and producing the toy for one year. There is an additional cost of 100,000USD to minimize the impact of residuals upon the environment through disposal. However, your client is legally entitled to dispose of the raw residuals without paying the additional cost. The annual *accounting profit* and *true profit* are:

a) 5,000,000 and 3,500,000, respectively.

b) 1,500,000 and 1,400,000, respectively.

c) 1,400,000 and 1,500,000, respectively.

d) 3,500,000 and 1,500,000, respectively.

e) The production line will not result in profits of any kind.

Q1-9. Operating costs for this production line include:

a) Labour and machinery required to build the new production line.

b) Raw materials used in the production of the toy.

c) Electricity used to run the production line.

d) All of the above.

e) b and c only.

Q1-10. In the second and subsequent years of toy production, internal costs are estimated to be 1,500,000USD annually. If all other variables remain the same, then *accounting profit* and *true profit* for the 2nd year of production are:

a) 3,500,000 and 1,500,000, respectively.

b) 1,500,000 and 3,500,000, respectively.

c) 3,500,000 and 3,400,000, respectively.

d) 3,400,000 and 3,500,000, respectively.

e) 1,500,000 and 1,400,000, respectively.

Q1-11. The *background* information that you provide in a presentation or speech should include:

a) Motivations for the topic, a problem statement, and contextual information for the audience.

b) A brief overview of what you will be discussing.

c) Your analysis, thoughts, and opinions.

d) Recommendations, suggestions, and key findings.

e) A few off-colour jokes to loosen up the audience.

Q1-12. When presenting to an audience with varying levels of expertise, you should:

a) Target your presentation to the novice (i.e. inexperienced) audience members.

b) Target your presentation to the experts in the audience.

c) Allow people to ask questions throughout your presentation rather than waiting until the end.

d) Strike a balance in the level of material being presented so that the novice can develop a basic understanding, while keeping the experts engaged.

e) Present the topic through interpretive dance, because nothing conveys engineering experimental results better than a jazzy pirouette.

Q1-13. You are the CEO of a large, engineering consulting firm. You have decided to expand your areas of focus from traditional chemical engineering to include a tissue engineering practise, in order to sustain your present rate of growth. This can be classified as:

a) A *tactical* decision

b) A *strategic* decision

c) An *operational* decision

d) A *true profit based* decision

e) A decision to become the next Dr. Frankenstein

Q1-14. While it is true that engineering projects are often far-reaching in terms of the people that are directly and indirectly impacted, it is important to establish a realistic set of stakeholders that are of primary concern. Suppose you are leading a design project for a company that builds wooden cribs for babies. Which of the following stakeholders is least important to the design process:

a) The crib company.

b) Parents who purchase the crib.

c) Government agencies that regulate the product safety standards.

d) Retailers that will stock the crib in their stores.

e) Loggers that harvest trees used in the manufacturing process.

Q1-15. As an engineer, your responsibilities include:

a) Using your skills and capabilities to gather information from stakeholders.

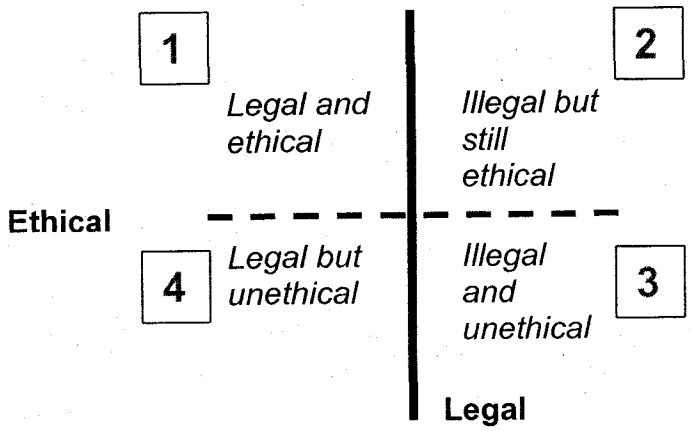
b) Proposing creative designs that consider the environment and society in addition to the required functionality, objectives, and constraints.

c) Taking reasonable measures to ensure that all relevant issues, concerns, and constraints are considered.

d) All of the above

e) a and b only

Q1-17. Consider the diagram below. Choose the statement that is true.



a) Quadrant **4** is where most ethical dilemmas are found.

b) Making decisions that lie in Quadrant **3** is fine provided you do not get caught.

c) Having to make a decision that lies in Quadrant **2** is relatively common.

d) Quadrant **1** is often not a desirable place to be.

e) This is really of no concern to engineering – we just build things based on requirements.

Q1-16. Professional engineering codes of ethics:

a) Can serve as laws.

b) Can lead to fines, suspension of licence, or loss of licence if violated.

c) Are established to provide guidance and to help resolve ethical dilemmas.

d) All of the above

e) b and c only

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Q1-18. Reasons to strive for resource sustainability include the following:

a) Stabilization of long-term prices is attainable with a sustained supply of a resource.

b) One can establish a monopoly if they can control the supply of a commodity.

c) The price of a crucial resource will likely rise dramatically if its supply becomes limited.

d) All of the above

e) a and c only

Q1-19. For any given design, you should establish metrics that:

a) Include a valid range of values, measurements, dimensions, and possible tests/ validations.

b) Are specific and qualified.

c) Both a and b.

d) Operating costs.

e) Performance objectives.

Q1-20. Identification and analysis of stakeholders is critical because:

a) They help identify the life cycle of the design.

b) They help identify environmental impacts of the design.

c) They are essential to identifying a comprehensive set of objectives, constraints, and functionality, the scope of the project, and who will approve/validate the design.

d) All of the above

e) a and c only

Q2.	Value	Sugg. Time	Purpose
	20/100	30 min	To demonstrate knowledge in the areas of human factors, stakeholder analysis, lifecycle analysis, economics

Q2A-E. Define the following in one – two sentences:

Q2A. Total revenue **(1/20)**

Q2B. Accounting profit **(1/20)**

Q2C. True profit **(1/20)**

Q2D. Internal costs **(0.5/20)**

Q2E. External costs **(0.5/20)**

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Q2F. Capital costs **(0.5/20)**

Q2G. Operating costs **(0.5/20)**

Q2H. Define engineering and list four essential skills that engineers are expected to develop through their curriculum. **(5/20)**

Q2I. Describe the *human-tech ladder* as outlined in Kim Vicente's "The Human Factor". **(5/20)**

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Q2J. Relate your toy design to the *human-tech ladder*, and discuss the human factors that are most important to your design. **(5/20)**

Q3.	Value	Sugg. Time	Purpose
	20/100	30 min	To demonstrate the ability to clearly communicate about your design project.

Q3A. Provide a high-level life cycle diagram for your design project (i.e. the toy you have designed for Dynatec), along with a brief description, relating it to potential impacts upon the environment. **(10/20)**

Q3B. Illustrate the suitability of your final (tutorial project) design to your client's needs by describing its attributes and relating it to your documented objectives, constraints, and key functionality. i.e. Tie the decisions you made in your design (and the features of your design) to your objectives, constraints, and key functionality. **(10/20)**

Q4.	Value	Sugg. Time	Purpose
	20/100	40 min	To demonstrate effective communication skills.

Q4A. Explain when it is appropriate to use a bulleted list in a technical report. **(5/20)**

Q4B. The following passage contains at least 10 writing errors/problems. Identify five of the errors by circling each error, and labelling the errors 1 through 5. **(5/20)**

Detailed Design #1

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 double-sided static 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 2.5 N, thereby making the total amount of books in each double-sided shelf approximately 23350 N. Since Tyndale desperately 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), it will require approximately 8 regular static double-sided shelves to allow for the minimum expansion required. However, it's likely that the library may expand its 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% [4], 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 areas.

Q4C. Describe how you would fix each error. **(5/20)**

1.

2.

3.

4.

5.

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Q4D. What are the three attributes of a credible statement? **(3/20)**

1.

2.

3.

Q4E. Provide an example of each component (of a credible statement) that is related to your design project. **(2/20)**

1.

2.

3.

Q5.	Value	Sugg. Time	Purpose
	20/100	30 min	To demonstrate the ability to research an engineering topic, describe the underlying issues, and provide insightful analysis of the root cause problem, potential solutions, etc.

Q5. Discuss the topic that you were assigned for your tutorial presentation. Provide background information, along with your analysis, findings, and recommendations, conclusions, etc. **(20/20)**

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