University of Toronto, Faculty of Applied Science and Engineering
APS111 & APS113 Engineering Strategies and Practice
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Final Examination Question Booklet
Start: December 11, 2020, 6:00 am ET (Toronto Time)
Finish: December 11, 2020, 6:00 pm ET (Toronto Time)

Declaration

In submitting this assessment, I confirm that my conduct during this final exam adheres to the Code of Behaviour on Academic Matters. I confirm that I did NOT act in such a way that would constitute cheating, misrepresentation, or unfairness, including but not limited to, using unauthorized aids and assistance, impersonating another person, and committing plagiarism. I pledge upon my honour that I have not violated the Faculty of Applied Science & Engineering's Honour Code during this assessment.

Final Exam Instructions

- We estimate this final exam will take 150-minutes to complete the five questions.
- Type X: An "open book" examination. The candidate may bring to the examination and use, any books, notes or other printed or written material, without restriction.
- You may not solicit or provide exam information to or from anyone outside of the teaching team during the exam period.
- Type your responses directly into the final exam answer booklet. Do NOT input your answers into this booklet.
- The word count indicates our expectations for each question, but it is not an enforced word limit. We want you to get to the point and not ramble, but also do not spend excessive time editing for concision.
- The marks listed on each question indicate our expectations.
- You can submit your completed answer booklet as a .docx or PDF into Quercus as per the instructions below.
- Remember to save your work frequently! Good luck!

Part 1: Writing the Final Exam

1. Download three documents: Final Exam Client Statement (PDF), Final Exam Questions Booklet (PDF), and the Final Exam Answer Booklet (.docx) to your computer.
2. Rename the final exam answer booklet to the following where you insert your name and student number for the placeholders.

   APS111_Exam_First name_Last name_Student number

   APS113 students should use "APS113" in place of "APS111" in the naming convention.

3. Read the Client Statement (see the separate PDF).
4. Answer the 5 questions by typing directly into the final exam answer booklet. Be sure to save the document frequently as you work.

Note: Completing the final exam answer booklet does not in itself constitute submission of the final exam. You must submit in Part 2: Submitting the Final Exam.

Part 2: Submitting the Final Exam

Once you have completed the final exam answer booklet in Part 1: Writing the Final Exam, you must submit it. You must do this through Quercus. **DO NOT** email the files to us. The process of submitting your final exam through Quercus is detailed below.

To submit your final exam answer booklet (.docx or PDF) into Quercus.

1. Click on Submit Assignment.
2. Click on Choose File and then select your completed final exam answer booklet file (.docx or PDF) (*APS111_Exam_First name_Last name_Student number*).
3. Check off the box "I agree to the tool's End-User Licence Agreement. This assignment submission is my own, original work."
4. Click on *Submit Assignment*.

Final Exam Questions

0) **READING COMPREHENSION:** Careful read the Client Statement. Analyze the Client Statement noting important phrases that maybe indicate gap, scope, functions, objectives, constraints and other course concepts. Do not submit this analysis but use it to answer the following questions. This question is here to indicate what your first step should be. Do **NOT** submit anything for this question.
   [0 marks; 30 minutes; 0 words]

1) **PROBLEM STATEMENT**: Write a concise Introduction and Problem Statement in your own words. The required content listed below must be included and clearly indicated to the reader, however, be sure to write this as a single Problem Statement, and not a series of disjointed sentences. We are **NOT** looking for a bulleted or numbered list. Use the Client Statement only, you do not have to do any additional research.
[25 marks; 30 minutes; 300-500 words]

   Required Content:
   1) Introduction – Introduce the client, the project, and the current situation.
   2) Important Context – What are the essential contextual factors to consider?
   3) Gap – What is missing in the client's world?
   4) Scope – What are the boundaries on the design space?

   Do **NOT** include:
   1) Solutions
   2) Sentences copied word-for-word form the Client Statement.
   3) Headers
   4) Functions, objectives or constraints
   5) Additional research

2) **DETAILED REQUIREMENTS**: Identify the components that you would use to write a Detailed Requirements. The required processes and content listed below must be included and clearly indicated to the reader. This does **NOT** have to be a complete Detailed Requirements. A series of bulleted lists along with your work done on the processes is fine.
[25 marks; 30 minutes; 250 words]

   Do **NOT** include:
   1) Solutions
   2) Sentences copied word-for-word form the Client Statement.
   3) Headers or introductions. A series of bulleted lists is fine.
   4) Additional research

   a. 1 Primary Function
      - Use Functional Basis to identify **ONE** Primary Function for the problem described in your Problem Statement in Question 1. Write this **ONE** Functional Basis in your answer **using the proper two component format** without qualifiers.
      - Write a well-formed Primary Function from this Functional Basis.
      - In your answer clearly label which is your Functional Basis and which is your Primary Function.
      - Do **NOT** include more than **ONE** Functional Basis. Do **NOT** include more than **ONE** Primary Function. If you do only the first one of each will be marked.

   b. 3 Secondary Functions
      - Use Functional Decomposition to derive these **THREE** secondary functions. Include your completed Functional Decomposition chart here.
      - Do **NOT** include more than **THREE** Secondary Functions. If you do only the first three will be marked.

c. 3 Objectives including Metrics and Goals
   - Use a Pairwise Comparison table to rank these **THREE** objectives. Include this table here. List the Objectives in order of the most important first.
   - Do **NOT** include more than **THREE** Objectives. If you do only the first three will be marked.
   - You do not need to backed up these metrics and goals with research, as you normally would be required to do. Instead, provide an estimation and your assessor will evaluate the reasonableness of this estimation

3) **IDEA GENERATION**: Use Functional Decomposition and a Morphological Chart to generate **THREE** possible solutions to the problem you defined in your Problem Statement (Question 1) and Detailed Requirements (Questions 2).
   [25 marks; 30 minutes; 250 words]
   a. Copy the Functional Decomposition you generated in Question 2 and paste it here.
   b. Add a row of Means to the Functional Decomposition. Include **THREE** means for each of your three Secondary Functions. Do **NOT** include more than **THREE** means for each Secondary Function. If you do only the first three will be marked.
   c. Create a Morphological Chart using these **NINE** means statements. Include this chart here. Draw lines through this Morphological Chart to generate **THREE** complete solutions.
   d. In 25 words, name and describe the first of the three possible solutions and explain how it works. You may include a labelled sketch, but it is **NOT** required.
   e. In 25 words, describe the second of the three possible solutions and explain how it works. You may include a labelled sketch, but it is **NOT** required.
   f. In 25 words, describe the third of the three possible solutions and explain how it works. You may include a labelled sketch, but it is **NOT** required.

4) **IDEA SELECTION**: Use a Pugh Method and the three ranked Objectives you determined in Question 2 to recommend a design to your client. Use the Client Statement only, you do not have to do any additional research.
   [10 marks; 15 minutes; 150 words]
   a. Use Pugh Method and the **THREE** ranked Objectives (Question 2) to determine a recommended design. Include your completed Pugh Method chart here. You do **NOT** need to include a justification column.
   b. Justify why your recommended design would solve the problem you identified in the Problem Statement. Include discussion of the trade-offs between the Objectives in this justification.

5) **TEAM**: The design team working on this project is struggling to ensure that everyone is able to share ideas on what the solution should look like. They are seeking your advice as an upper year student who has completed ESP before and learned about how to be an effective team member.
   [15 marks; 15 minutes; 100 words]
   a. Why should the team develop a Team Charter to address this situation?
   b. What is one important way of working they should include to address this challenge? How will this way of working address the problem?
   c. What is one contingency plan that might need to accompany this way of working to ensure that everyone on the team can share ideas? Why?