APS111 Engineering Strategies and Practice

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Final Examination

MULTIPLE CHOICE BOOKLET – Booklet 1

December 08, 2023

9:30 am – 12:00 pm (2.5 hours)

- This is a 2.5 hour final exam with 44 questions (35 Multiple Choice and 9 Long Answer). The multiple-choice questions are worth 50% of the exam grade and the long answer are worth 50% of the exam grade.
- This is a Type A closed book examination; no aids permitted other than a paper translation-only dictionary (i.e. direct word-to-word translations; no definitions.)
- If you need scrap paper for draft work, ask an invigilator.
- Ensure that you have **THREE** items:
    1. **MULTIPLE CHOICE BOOKLET – Booklet 1**: Contains all the multiple choice questions. **DO NOT** record answers in Booklet 1. Instead fill in the answers to the multiple choice questions on the bubble page found in the ANSWER BOOKLET – Booklet 2. Booklet 1 is **NOT** handed in and the answers will **NOT** be graded.
    2. **ANSWER BOOKLET – Booklet 2**: has all the long answer questions, space to directly answer the long answer questions, and a bubble page to record the answers to the multiple choice questions. The answers to the long answer questions should be recorded directly into **Booklet 2**. Answers to the multiple choice questions should be recorded into the bubble page in **Booklet 2**. Booklet 2 **MUST BE** handed in at the end of the exam.
    3. **CASE STUDY BOOKLET – Booklet 3:** has three case studies. Case Study #1 and #2 are to be used to answer some of the multiple choice questions. Case study #3 is used to answer the long answer questions. **Booklet 3** is **NOT** handed in at the end of the exam.
- **THIS BOOKLET IS THE MULTIPLE CHOICE BOOKLET – Booklet 1.**

Multiple-Choice (50%):

- There are a total of 35 multiple choice questions worth a total of 35 marks. These multiple-choice questions are worth 50% of the exam.
- **Input your answers to the multiple choice questions on the bubble page at the end of Answer Booklet – Booklet 2.** Do **NOT** answer the multiple-choice questions on the questions directly in this booklet. They will not be graded.
- There is no penalty for incorrect answers.
- Use a pencil or a pen (pencil is recommended in case you make errors).
- Be sure to fill out the bubble page **clearly and darkly with no overlaps.**
- Erase any errors completely.
- Provide only the single, most correct answer for each question.

Multiple Choice Questions

ANSWERS FOR THE FOLLOWING MULTIPLE CHOICE MUST BE INPUTTED INTO THE BUBBLE PAGE IN THE ANSWER BOOKLET. ANSWERS RECORDED IN THIS BOOKLET WILL NOT BE MARKED.

1. What best defines a "prototype" in the design process?
   a. Any final version of a design concept
   b. Any component determined through functional decomposition
   c. Any representation used to communicate or iterate on a design concept
   d. Any alternative design that was tested

2. What does the term "engineering design space" refer to?
   a. The physical workspace where engineers collaborate
   b. The constraints that bound the possible solution space
   c. The space that describes the intersection of engineering and aesthetic design
   d. The space that encompasses possible solutions

3. How do constraints differ from objectives in engineering design?
   a. Constraints define the goals, while objectives provide specific values
   b. Constraints define the limits, while objectives differentiate solutions
   c. Constraints define the budget, while objectives define the scope
   d. Constraints and objectives are synonymous in engineering design

4. What does the term multi-modality refer to in engineering design?
   a. Designing multiple solutions for one problem statement
   b. Incorporating appropriate visuals throughout written documents
   c. Brainstorming designs that address multiple problems
   d. Supporting your engineering argument with graphs

5. What is triangulation in engineering research?

a. A method to observe and measure angles through primary research
b. The use of multiple methods and sources to support a claim
c. The development of 3 alternate designs at the same time
d. A method to narrow the scope of your design space

6. Which of the following are TRUE about patents?

a. They are only valid in specific countries
b. They last for up to 50 years after the author's death
c. They can be renewed
d. They keep design ideas secret

7. In the Pugh Method, what is the purpose of the datum?

a. To be the recommended solution
b. To be a reference when comparing designs
c. To be a boundary for the design space
d. To be the first alternate design to be eliminated

8. Regarding a "How-Why Tree", which of the following is **FALSE**?

a. You move up the tree by asking "Why?"
b. It is used to develop more detailed requirements
c. It is used to prioritize objectives
d. It is used to organize objectives

9. What is the recommended first step when approaching idea generation?

a. Get together with your team and brainstorm as many ideas as possible
b. Explore your first good idea thoroughly before generating more ideas
c. Consolidate the team list and perform a feasibility check
d. Independently brainstorm a list of ideas individually

10. During the second iteration of idea generation, the design team will

a. Disregard all previous results from the first iteration of idea generation

b. Significantly increase the project's scope

c. Generate additional solution candidates

d. Redefine all objectives and constraints

11. In the context of decision-making, what does pairwise comparison involve?

a. Comparing a single design against multiple objectives

b. Comparing each objective and against every other objective

c. Comparing a single design against the primary objective

d. Comparing the design ideas against the constraints

12. What is the primary purpose of defining objectives in engineering design?

a. To describe desired outcomes

b. To identify potential challenges

c. To establish constraints

d. To set limitations on the design process

13. How do metrics contribute to effective project communication among team members in engineering?

a. By reducing the need to exchange information

b. By providing a shared understanding for assessing success

c. By converting quantitative data into qualitative data

d. By establishing team goals for the project

14. Which of the following is the best use for benchmarking?

a. Setting goals based on existing designs

b. Promoting collaboration among team members

c. Facilitating a quantitative idea selection process

d. Selecting ideas by multi-voting

Questions 15 to 17 pertain to Case Study #1: Team Case Study found in the Case Study Booklet – Booklet #3.

15. Which of the following in the Team Charter Contingency Plan was likely the cause of this situation?

    a. Everyone decides on work re-allocation if someone does not complete their work on time.

    b. If conflicts arise within the team, matters will be dealt with by calling for a meeting and allowing each member to voice out concerns and find a common ground.

    c. Talk to the members about difficulties they may be experiencing.

    d. Project manager will make all planning decisions on behalf of the team when faced with an unexpected situation.

16. Laura would like to give Randy some feedback based on the situation. Which of the following feedback meets the AID model discussed in class?

    a. Everyone was disappointed with you. You should have told me directly that you will be away and will not complete your work on time.

    b. I am not sure why you decided to share with Jen directly about feeling unwell. I think as the project manager I should have been the one you should have communicated with about your situation. Please let me know in the future if you are unable to finish your tasks.

    c. When you communicated about being unwell to Jen, the team did not know until a day later. As you did not inform the team about your progress on the assignment, I found that all your sections were blank with no notes when I started to work on my sections. In the future, please communicate on the Teams channel about being away and give us access to any work you may have completed in your message.

    d. I was surprised that you did not begin your assigned section and left it for the team to complete it. I think you should have started your section a week before the deadline.

17. Which revision to the Team Charter should address this situation in the future?

a. Members must be punctual at meetings by arriving within 10 minutes of the planned time.

b. Team members will correspond all team-related issues on their team communication channel.

c. We will solve conflicts within the team by calling an emergency meeting.

d. All the team members should be responsible and fulfill their obligation by completing only the sections assigned to them.

End of questions pertaining to Case Study #1: Team Case Study.

Questions 18-35

pertain to Case Study #2 AquaEye Shallow Water Monitoring System found in the Case Study Booklet – Booklet #3.

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18. In the service environment section of the project requirements report, the best picture for the team to include would be:

a. A site plan of a specific beach, e.g. Sugar Beach, in Toronto

b. An image of the current AquaEye handheld device to illustrate the current technology

c. A diagram of a typical underwater environment with sand, rocks, depth changes, etc.

d. An illustration of the average person showing height, weight, and other characteristics

19. Which of the following best describes the gap related to the AquaEye project?

a. The sentence on lines 8-9, which starts "AquaEye is interested in advancing..."

b. The sentence on lines 9-12, which starts "Unlike the current handheld model..."

c. The sentence on lines 15-17, which starts "The primary goal of this project..."

d. The sentence on line 78-83, which starts "The success of the design will be..."

20. The scope of this project does **NOT** include creating a system that:

a. Operates underwater at a depth of 5m or less
b. Can be carried by a lifeguard
c. Pulls a distressed swimmer in to a safe location
d. Uses sonar

21. Which of the following is an example of an implied solution from the client statement?

a. Must work reliably when the device is submerged at 5m or less (i.e., the sentence on line 32)
b. Using an anchored buoy system that will hold the device in place (i.e., the sentence on lines 27-28)
c. Ensure the system meets all relevant regulatory and safety standards (i.e., the sentence on line 64)
d. Should be easy to deploy (i.e., the sentence on line 36)

22. Which of the following best describes the need related to the AquaEye project?

a. The sentence on lines 9-12, which starts "Unlike the current handheld model..."
b. The sentence on lines 15-17, which starts "The primary goal of this project..."
c. The sentence on line 78-83, which starts "The success of the design will be..."
d. The sentence on line 86-88, which starts "Our commitment is to create a product..."

23. Which of the following is most important for a Project Requirements document?

a. Privacy rules and regulations of the University of Toronto
b. List of beaches in Ontario
c. Power specifications for a display screen
d. International wireless communication codes and standards

24. Which of the following would be the best example of SCAMPER?

a. Analyzing similar designs to the AquaEye to determine objective goals

b. Separating the AquaEye into its structural or functional components

c. Reviewing AquaEye's inputs and outputs, in terms of mass, energy, and information

d. Combining part of the AquaEye technology with a floating buoy

25. The functional basis of the AquaEye project is best described as:

a. Detect a motionless swimmer using energy

b. Identify mass and communicate information

c. Retrieve information and transmit information

d. Convey location information to a lifeguard

26. Which of the following is a secondary function for the AquaEye design:

a. The design should be light

b. the design should operate for at least 8 hours

c. The design should detect a swimmer in distress

d. The design should maintain its position in the water

27. Suppose a lifeguard deploys a prototype of the new AquaEye system at a busy swimming area. The lifeguard takes their seat on the beach. The AquaEye prototype starts transmitting readings indicating that there is a 10% chance that there is a swimmer in distress. The system continues to read 10% over the next 10 minutes. These readings indicate that the prototype is:

a. Accurate, but unknown precision

b. Precise, but unknown accuracy

c. Accurate and precise

d. Neither accurate nor precise

28. What additional research would be most useful to complement the information given in the client statement?

a. Wifi coverage maps for Canada, detailed solar power calculations, and definition of extreme water temperatures

b. Comfortable water temperatures for swimming, average size of a beach goer, and signs of an average distressed swimmer

c. Maximum available solar power, range of water turbidity, and range of ocean salinity

d. Maximum and minimum range of audio alarms, maximum and minimum cost of manufacturing computer displays, and maximum and minimum ocean depths

29. The stakeholder in the Project Requirements with the greatest interest and influence is:

a. the engineering team

b. a swimmer at a beach

c. a lifeguard association

d. the test and standards regulatory body

30. Which of the following best describes the operators of the proposed design?

a. The engineering design team that is designing the system

b. People who are swimming at a beach where this system is deployed

c. A lifeguard who is on duty at a beach

d. The maintenance team at AquaEye who repairs broken systems

31. Which of the following is a constraint:

a. The system uses a backup power supply

b. The system should weigh less than 10kg

c. The system can scan $2000m^2$ or more

d. The system must meet FCC regulations

32. Suppose your team is using decomposition to generate categories to use in a morphological chart process. Which of the following would **NOT** be a category?

a. A plan for meeting FCC requirements
b. An anchoring or positioning sub-system
c. A means to communicate with the lifeguard
d. A method or approach to detect a swimmer in distress

33. During Brainstorming, the design team should only generate ideas that

a. use visual cues to alert the lifeguard
b. use solar energy for the backup power supply
c. are within the scope of the project
d. meet the constraints of the project

34. If only one graphical decision chart is used, the best analysis would use:

a. cost and weight
b. accuracy and ease of use
c. privacy and detection range
d. accuracy and regulatory compliance

35. Both the AquaEye project and the Biolite case study are examples of embodiment design (sometimes called platform design). This term refers to:

a. A design that uses the same core technology as an existing product or system
b. A design that is operated by individual users rather than a whole company
c. A design that is aligned with the company's values and mission
d. A design operates in a natural, rather than manmade, service environment

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End of questions for Case Study #2: *AquaEye Shallow Water Monitoring System*.

End of Multiple-Choice Questions.

There are no more questions in this booklet.
