

## National Exams December 2019

### 16-Mex-B8, Product Design and Development

THREE (3) hours duration

#### **NOTES:**

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.
2. This is an OPEN BOOK EXAM. A Casio or Sharp approved calculator is permitted.
3. Question ONE (1) must be completed and is worth 40%, choose FOUR (4) out of the SIX (6) remaining questions each worth 15% for a total of 100%.
4. The first FIVE (5) questions as they appear in the answer book will be marked.
5. Most questions require an answer in essay format or the use of tables, figures and charts. Clarity and organization of the answer are important.

## QUESTION 1 MUST BE COMPLETED.

Question (1) (40 Marks)

Aircraft typically have long development cycles and extensive certification procedures for this reason aircraft designs are updated on long production cycles. Consider being the design team lead tasked with updating an older model aircraft addressing the unique challenges associated with the aerospace industry.

This problem explores what is involved in realizing a new design for an aircraft that has not been updated for 50 years. In your answer please factor in new technology, materials and design approaches.

\*Suggestion: This is meant to be an open-ended question where your ability to outline and follow a defined design process to meet the objective is more important than the actual design that you come up with. To this end develop a design direction and consistently follow A. – E. showing your key decisions made through your design process. I would recommend focusing your improvements at a high-level and discuss the actual design in general terms.

- A. Start by picking your team and highlighting the FOUR (4) most important skill sets you are looking for in the individuals who will anchor your team.
- B. Identify THREE (3) high level design objectives and outline why they are important for a modern aircraft to be competitive in today's marketplace.
- C. Pick one design objective identified in part B and propose THREE (3) competing solutions or approaches to realizing the design objective.
- D. Highlight a strategy for selecting the best option from competing solutions and demonstrate your strategy using the THREE (3) competing solutions proposed in part C.
- E. Outline your strategy for converting the associated design solution picked in part D into specifications, documenting and then communicating the design information to the broader design team working on other aspects of the aircraft design.

**CHOOSE FOUR (4) OUT OF THE SIX (6) REMAINING QUESTIONS.**

Question (2) (15 Marks)

- A. Outline how government regulations impact a final design.
- B. Provide THREE (3) examples of automotive regulations that impact a car's design.
- C. What steps can be taken in the design process to improve compliance with regulations?
- D. At what stage in the design process should regulations and industry standards be considered in design.

Question (3) (15 Marks)

- A. What are some of the first indications that a product design process is going badly, identify and describe THREE (3)?
- B. For each of the problems listed in part A outline what you could do to rectify the situation and bring the project back on track.

Question (4) (15 Marks)

- A. Why are nondisclosure agreements used?
- B. Why are patents used?
- C. What are the basic requirements for a successful patent?
- D. If two people have the same idea who does the patent get awarded to in Canada?
- E. What is required of a patent holder after a patent is issued?

Question (5) (15 Marks)

- A. Provide a functional definition of design.
- B. Using a commonly available product outline how its functional design features differ from its aesthetic ones highlighting the steps the designer took to rationalize these two aspects to realize a successful product.
- C. What THREE (3) key pieces of information are needed to be communicated for each component on a drawing in order to complete a full system design involving multiple parts that interact to form a system?

Question (6) (15 Marks)

- A. Describe how Design for Manufacturing and Design for Assembly can be used together to realize a lower cost product.
- B. Provide THREE (3) examples of improvements to a design that meet both the objectives of Design for Manufacturing and Design for Assembly.
- C. Outline a strategy for consistently achieving both Design for Manufacturing and Design for Assembly in a facility that both designs and manufactures their own products.

Question (7) (15 Marks)

- A. Identify and describe FIVE (5) distinct stages of a product development process.
- B. Describe the decision process for moving between the stages identified in part A.
- C. What are some of the issues with starting multiple development stages at once?
- D. How would you manage an iterative approach to product development when using a design approach involving distinct stages?