National Exams May 2017

16-Mec-B5, 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. One of two calculators Casio or Sharp.

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)

Select ONE (1) of the following THREE (3) products and use it to demonstrate how you would improve the functionality of the product. The focus for this question is on incorporating design features in products that improve ease of use and range of applications.

i. Car stereo
ii. Household blender
iii. Computer desk

*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 improvement that you come up with so develop a design direction and consistently follow A-E showing some key decisions made in the design process. I would recommend focusing your improvements at a high-level and discuss things like overall shape, size and functionality of main features of the full product, consider how the main components interact and how the product interacts with the end user as well as major material, manufacturing, use and disposal issues which trigger costs.

A. List and describe THREE (3) very general ways one can get end customer input at the start of the design process. Pick one of the methods and outline how you would develop it into a useful activity.

B. Pick ONE (1) product from the list above and then outline THREE (3) ways that you could use input from end customers to improve its functionality.

C. Outline and describe how your design change might impact society in general. List and discuss THREE (3) general improvements that could be made to improve the impact on society.

D. Discuss how you would convert design improvement ideas into realistic engineering specifications to implement your changes.

E. Sometimes not all design specifications can be met. Outline and describe how you would go about establishing priorities for the design.

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

Question (2) (15 Marks)

A. Provide a functional definition of Design as a process and Design as an outcome.
B. Summarize some of the important steps in a design process.
C. Comment on the importance of iteration in the design process.
D. List the key requirements that define a final complete design.

Question (3) (15 Marks)

In some cases design involves small incremental improvements in other cases design involves radical changes in technology.

A. Within this context how would you view the introduction of the Apple iPad when it was first introduced?
B. Comment on how consumer adoption differs for radical and incremental design changes. How can this be influenced?

Question (4) (15 Marks)

A. Why are nondisclosure agreements (NDA) used?
B. Explain why a company would chose to patent an idea.
C. What is required in order to patent a product?
D. Explain why a company would chose to keep an idea as a trade secret.

Question (5) (15 Marks)

There has been considerable discussion around the notion that Canada is lagging behind other regions in the world in terms of innovation.

A. Outline how design influences innovation.
B. Describe the role that materials have on innovation potential.
C. Describe the ways in which developments in manufacturing processes can impact innovation.

Question (6) (15 Marks)

A. Outline the process you would go through to enhance the reliability or robustness of a door lock.
B. Describe a way in which you could test this.
C. How would you measure and quantify reliability and robustness over the long term for a new door lock design?

Question (7) (15 Marks)

A. Select THREE (3) different materials that can be used to manufacture a chair and the challenges associated with using each material.
B. Outline how final use of the chair would impact the choice of material.
C. Outline how the choice of material impacts the manufacturing process.
D. Develop a framework for material selection and apply it to select the material to make the chair.