National Exams May 2018

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 is permitted - any Casio or Sharp approved model.

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. Full Marking Scheme on Page 4.

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 a typical design to reduce weight.

i. Automobile
ii. Aircraft
iii. Bicycle

*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 your design process. I would recommend focusing your improvements at a high-level and discuss the design in general terms.

A. List and describe THREE (3) very general ways one can redesign a product to reduce weight.

B. Using ONE (1) of the products listed above outline how the THREE (3) ways listed in Part A can be applied to reduce the weight of critical components.

C. Outline and describe how your design changes from part B will impact the manufacturing process.

D. Discuss how you would convert high level weight reduction improvement ideas into realistic engineering specifications for specific parts to realize your objective of weight reduction.

E. In many cases not all design specifications can be met. Outline and describe how you would go about establishing priorities as part of the design process.

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

Question (2) (15 Marks)

A. Compare the design process an engineer goes through to design a functional part versus the process an artist goes through to design an art installation.
B. Describe the challenges associated with capturing the design details in each case.
C. Comment on the importance of iteration for both design processes listed in A.
D. Summarize how you would assess the success of each process outlined in A.

Question (3) (15 Marks)

A. Propose FIVE (5) ways design activity has changed over time. Consider ancient times to present.
B. Identify and describe Two (2) new technologies that you see facilitating the design process in the future.

Question (4) (15 Marks)

Consider the process one would go through to protect an idea:
A. Why is it important to protect intellectual property associated with your product?
B. What role does a nondisclosure agreement serve?
C. List FIVE (5) options that are available for protecting your idea.
D. Provide ONE (1) example product where each is used for the FIVE (5) options listed in B.

Question (5) (15 Marks)

A. Compare the thought process a designer developing a totally new product would go through versus a designer refining a product.
B. Describe where they could each turn to get customer data and some of the challenges associated with collecting and interpreting the data.
C. How would each engineer assess the success of their final design?

Question (6) (15 Marks)

A. Discuss the information a designer needs to communicate to the manufacturing team.
B. Describe the challenges a design engineer would experience working with a manufacturing team located a large distance away.
C. Outline and describe THREE (3) tools that are commonly used to facilitate the communication process between designers and the manufacturing team?

Question (7) (15 Marks)

A. Identify and discuss FIVE (5) phases a new product design goes through as part of the development process.
B. Outline how one could establish success within each phase listed in A to move on to the next phase.
C. Describe the benefits and challenges associated with trying to compress the phases outlined in A.

Marking Scheme:

Required Problem (40 marks)

1. (a) 8 marks
   (b) 8 marks
   (c) 8 marks
   (d) 8 marks
   (e) 8 marks

Choice 4 of remaining 6 (60 marks):

2. (a) 4 marks
   (b) 4 marks
   (c) 3 marks
   (d) 4 marks

3. (a) 10 marks
   (b) 5 marks

4. (a) 3 marks
   (b) 2 marks
   (c) 5 marks
   (d) 5 marks

5. (a) 6 marks
   (b) 5 marks
   (c) 4 marks

6. (a) 6 marks
   (b) 3 marks
   (c) 6 marks

7. (a) 5 marks
   (b) 5 marks
   (c) 5 marks