

National Exams December 2011

07-Mec-B5, Product Design & 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. No 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.

MUST BE COMPLETED.

Question (1) (40 Marks)

Select ONE (1) of the following THREE (3) products and use it to demonstrate your understanding of the design process. Please see the comments provided for general suggestions.

i. Electric Car

Focus on the location of the motor and the power source. Consider different options which may be cheaper or easier to manufacture using standard off the shelf components or custom parts specially designed for this application.

ii. Roof top solar panel mounting assembly

In your design consider the mounting brackets which attach it to the roof of a house and special functionality which gets the most energy from a standard solar panel.

iii. Cell phone

Consider different configurations involving the keyboard and display. Focus on how a person interacts with a phone when they use it in different ways including: talking, storage/standby, charging, etc.

* This is meant to be an open ended question where the process is more important than the actual design so develop a design direction and consistently follow it through to completion.

- A. Outline THREE (3) design requirements that must be satisfied for the product you have selected.
- B. Using simple sketches show THREE (3) different general design concepts which address the design requirements you outlined in A, in different ways.
- C. Describe the different analysis techniques that you would apply as part of your design process to assess functionality and finalize the product design.
- D. Develop a set of criteria which encompass the design requirements outlined in part A and use it to compare and contrast the different design ideas outlined in part B.

Choose Four (4) out of the SIX (6) remaining questions.

Question (2) (15 Marks)

- A. Provide a definition for sustainability within the context of product design.
- B. Identify and describe the major points in the life cycle of a product that have the largest impact on sustainability.
- C. How can the product design process be used to maximize the sustainability of a product?

Question (3) (15 Marks)

- A. List and describe FIVE (5) major considerations when selecting a material for a product design.
- B. Identify and describe a functional test that would assess the suitability of a material for a product given the considerations listed in part A.

Question (4) (15 Marks)

- A. List and describe TWO (2) major considerations when selecting the dimensions of a final product.
- B. Outline how dimensional information is communicated in a design. Be sure to include comments on manufacturability and assembly as well as final use.

Question (5) (15 Marks)

- A. Describe the Design for Manufacture and Assembly (DFMA) process and outline how it can be used to improve the design of a product.
- B. How would you expect the design of a product to change after applying a Design for Manufacture and Assembly (DFMA) process?

Question (6) (15 Marks)

- A. What are the main considerations that need to be taken into account when deciding how to protect a new design?
- B. Outline a realistic process one would go through to protect a new design.

Question (7) (15 Marks)

- A. Outline the skill sets needed by a design team to develop a new 3-Dimensional television system.
- B. What are some of the challenges associated with spreading the design team over different areas of the world?
- C. What would you do to reduce the negative effects of these challenges on your design team?

Marking Scheme

Problem 1 Must be completed

1. (a) 6 marks
- (b) 15 marks
- (c) 9 marks
- (d) 10 marks

Select 4 out of the remaining 6 problems:

2. (a) 5 marks
- (b) 5 marks
- (c) 5 marks
3. (a) 10 marks
- (b) 5 marks
4. (a) 5 marks
- (b) 10 marks
5. (a) 5 marks
- (b) 10 marks
6. (a) 7 marks
- (b) 8 marks
7. (a) 5 marks
- (b) 5 marks
- (c) 5 marks