

## National Exams December 2012

### 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.

**QUESTION 1 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.

- i. Bed Side Clock Radio
- ii. Bicycle for the Elderly
- iii. Office Chair for the Handicapped

\*Suggestion: 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. I would recommend focusing your specifications of interest at a high level and discuss things like overall shape and size of main features and the full product, consider how the main components interact and how the product interacts with the end user as well as major cost factors.

- A. Pick one product from the list and outline three (3) different ways of establishing design specifications for these products.
- B. Pick one of the methods you identified in part A and summarize the nature of the information that would be potentially collected for the product you choose.
- C. Using the general data summary from part B generate a set of realistic specifications for your product.
- D. Using simple sketches show THREE (3) different general design concepts which address the design requirements you outlined in B.
- E. Outline a methodology that could be applied to compare the design alternatives.
- F. Apply your methodology to rank your design ideas and select one design as the best one.

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

**Question (2) (15 Marks)**

- A. Provide a functional definition of design including both design as an action and as an object.
- B. Highlight some of the technical and professional backgrounds a successful design team needs to have.
- C. How do design backgrounds differ for members on the team working on the structural aspects of a bridge for example versus its aesthetic aspects?

**Question (3) (15 Marks)**

- A. Compare and contrast principles of universal design with sustainable design and design for manufacturing & assembly.
- B. Discuss how each of these would impact the design of a common household item.
- C. Outline how one could go about incorporating all of these design principles into one design process.

**Question (4) (15 Marks)**

- A. Define a stage gate process as it relates to the design cycle.
- B. Identify three (3) critical points in a design process where stages are typical placed.
- C. Outline some of the challenges of integrating concurrent engineering into a design process that is also using a stage gate approach.

**Question (5) (15 Marks)**

- A. Describe why a non-disclosure agreement is often put in place before a design is discussed with other outside partners.
- B. Identify and describe five (5) different options for securing intellectual property (IP) associated with a design.

**Question (6) (15 Marks)**

- A. How are society's interests protected when establishing a new design?
- B. How should this impact a company's design process and team?
- C. Outline the impact that this can have on timing and costs.

**Question (7) (15 Marks)**

Consider a bicycle crank arm (part of the pedal assembly) as shown on the right.

- A. Outline three (3) different ways of manufacturing this part.
- B. What factors in design are important in choosing a final manufacturing process?
- C. Develop the framework of a selection method for choosing the best manufacturing technique for your target market based on your design.



## Marking Scheme

### Required Problem (40 marks)

1. (a) 6 marks
- (b) 9 marks
- (c) 9 marks
- (d) 6 marks
- (e) 4 marks
- (f) 6 marks

### Choice 4 of remaining 6 (60 marks):

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