

National Exams December 2009

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.
Any non-communicating calculator is permitted.
3. FIVE (5) out of the SEVEN (7) questions constitute a complete exam paper.

The first FIVE (5) questions as they appear in the answer book will be marked.
4. Each question is of equal value.
5. Most questions require an answer in essay format. Clarity and organization of the answer are important.

Question (1) (20 Marks)

- A. Provide TWO (2) working definitions of design; one as a noun and the other as a verb.
- B. How does design relate to inventing and innovating?
- C. Outline and discuss FIVE (5) general factors which could be used to evaluate whether a design is good or bad.
- D. Discuss how society's interests can be represented in a design process?

Question (2) (20 Marks)

- A. Describe FIVE (5) features of a sustainable (environmentally friendly) design.
- B. Is Design for Manufacturing and Assembly (DFMA) compatible with sustainable design concepts? Explain your answer in detail and provide an example.
- C. Is "Lean Manufacturing" compatible with sustainable design concepts? Explain your answer in detail and provide an example.
- D. Outline steps that can be taken to make the process of "outsourcing" (shifting design and manufacturing activities to low labour cost areas) more sustainable.

Question (3) (20 Marks)

- A. Identify and describe FIVE (5) distinct phases in a product development process.
- B. Describe the decisions that need to be made after each phase and how iteration can be used to save money and develop a better design.
- C. Outline how concurrent engineering can impact product development costs and timelines.

Question (4) (20 Marks)

- A. Identify and describe FIVE (5) sources of design information or ways of defining customer needs and wants.
- B. Give THREE (3) examples of how one can convert design information into engineering technical requirements.
- C. Outline a process by which competing designs can be compared and the best design selected.

Question (5) (20 Marks)

- A. Discuss the advantages and disadvantages of taking a team approach to design.
- B. Describe the characteristics of a high performing design team.
- C. What role should the design team leader play?

Question (6) (20 Marks)

- A. State and describe FIVE (5) different methods a company can use to protect its intellectual property.
- B. Discuss the advantages and disadvantages of each method outlined in A.
- C. Provide an example where each method outlined in A can be applied.
- D. Outline the process involved in implementing each method outlined in A.

Question (7) (20 Marks)

- A. Consider a simple part like a metal wheel rim from a car. Describe THREE (3) different manufacturing processes that can be used for manufacturing it.
- B. Outline how the design process will change depending on which manufacturing process is chosen.
- C. Pick one of the processes outlined in part A and outline the steps involved in performing a Failure Modes and Effects Analysis (FMEA) on the process.

Marking Scheme

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