National Exams December 2008

07-Mec-B5, Product Design & Development

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 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)

List 5 modern tools and methods used in product design and development. Describe each and provide examples of their application specifically identifying how the use of the tool or method can impact the product design or development process.

Question (2) (20 Marks)

A) Provide a working definition of product design.
B) What extra steps are required to complete a full scale product development process?
C) Outline a product development approach that can be followed to make a refinement on an existing product in a mature market segment.
D) Outline how this approach would change if it were to be applied to a fundamentally new product idea in a new market segment.
E) Compare and contrast the traditional approach outlined in C with the one you are recommending in D in terms of human involvement, cost, risk, allocation of resources and timeline.

Question (3) (20 Marks)

A) Develop a series of questions that establishes the technical specifications of only ONE (1) of the following components in a system.
   i) Spring in a simple mechanical system
   ii) Column in a pedestrian bridge
   iii) Light Emitting Diode (LED) in a simple electrical circuit

B) Develop a framework for how different designs can be compared so that the design that best meets the technical specifications can be selected.

Question (4) (20 Marks)

A) Outline TWO (2) guiding principles for Design for Manufacturing and Assembly (DFMA) and describe the impact they can have on product design and development.

B) Describe the conflict that can often occur between Design for Manufacturing (DFM) and Design for Assembly (DFA). How can this conflict be resolved?

C) When the final design is going for manufacturing what aspects of a design need to be considered if it is going to be assembled manually or using fully automated equipment?

D) Are Design for Manufacturing and Assembly (DFMA) concepts consistent with "Lean Manufacturing" concepts? Discuss the relationship in detail.

Question (5) (20 Marks)

A) What are some of the first indications that a product design or development process is going badly?
B) List FIVE (5) common underlying causes.
C) Identify ONE (1) corrective action that can be taken to address each cause listed in part B.

Question (6) (20 Marks)

Consider THREE (3) commonly applied manufacturing processes that could be used to produce a Personal Computer (PC) case and identify the key limitations of standard processing machines in terms of geometry, surface finish and quality then discuss the impact that this limitation has on the design of the PC case.

Note: Many of these limitations are being overcome by new features on machines or custom capability that you may be aware of. If this is the case consider a standard machine and then show how a recent development has resolved the limitation and extended the design range of parts produced on that particular machine.

Question (7) (20 Marks)

Imagine that you as a private inventor have an idea that you believe is unique and novel which you want to pursue through to commercialization. Outline the Intellectual Property process that should be followed during the commercialization process of your idea that works to protect your ownership of the idea.

Note: Clearly many different scenarios can exist; the most important aspect of your answer is following a consistent plan for commercialization.

Marking Scheme

1. 20 marks total (5 items times 4 marks each)
2. (a) 2 marks
   (b) 3 marks
   (c) 5 marks
   (d) 5 marks
   (e) 5 marks
3. (a) 10 marks
   (b) 10 marks
4. (a) 5 marks
   (b) 5 marks
   (c) 5 marks
   (d) 5 marks
5. (a) 5 marks
   (b) 10 marks
   (c) 5 marks
6. 20 marks total (List 3 descriptions 10 marks; impact 10 marks)
7. 20 marks total