



# **NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**FACULTY OF INDUSTRIAL TECHNOLOGY**

**DEPARTMENT OF INDUSTRIAL AND MANUFACTURING ENGINEERING**

**BACHELOR OF ENGINEERING (HONS) DEGREE INDUSTRIAL AND MANUFACTURING ENGINEERING**

**CONCURRENT ENGINEERING I**

**TIE 3119**

**First Semester Main Examination Paper**

**December 2014**

This examination paper consists of 5 pages

**Time Allowed: 3 hours**

**Total Marks: 100**

**Special Requirements: N/A**

**Examiner's Name: N. Gwangwava**

## **INSTRUCTIONS**

1. Answer any four (4) questions
2. Each question carries 25 marks
3. Use of calculators is permissible

## **MARK ALLOCATION**

<b>QUESTION</b>	<b>MARKS</b>
1.	25
2.	25
3.	25
4.	25
5.	25
6.	25
<b>TOTAL</b>	<b>100</b>

### Question 1

- a) Explain, with the aid of well annotated diagrams, the difference between concurrent engineering and the traditional sequential approach to new product research and development. [6]
- b) Identify and explain new technology push and market pull factors that are influencing the forward movement of the refrigerator product. [10]
- c) A local manufacturing firm has decided to invest in new product research and development as a strategy to boost its business. State and explain any three areas where the firm can channel its financial resources. [9]

### Question 2

- a) Define and explain the importance of benchmarking in new product research and development. [2]
- b) List any five (5) steps that you follow in order to carryout an effective benchmarking exercise. [5]
- c) Table Q2c below shows a matrix of candidate '*Technical Performance Measures*'- *TPMs*, state typical examples of TPMs under each category as indicated in the Table Q2c.

*Table Q2c: Candidate TPMs*

Information Category	Measurable Concept	Typical TPM example
Product Size and Stability	Physical Size and Stability	..... [1]
		..... [1]
Product Quality	Functional Correctness	..... [1]
		..... [1]
Technology Effectiveness	Technology Suitability	..... [1]

- d) State three (3) different methods that can be used to gather the customer's voice (Needs or Whats) for deployment into the first house of quality (HOQ). [3]
- e) Use the Quality Function Deployment- QFD technique to populate the first house of quality- HOQ for any product design of your choice. [10]

### Question 3

- a) Define the term ‘*concept*’ as used in product design. [1]
- b) Concept generation methods can be classified into basic and logical methods. Identify any two methods that fall under each of the following concept generation categories;
- Basic methods [2]
  - Logical methods [2]
- c) State the ten (10) steps followed in concept generation and selection. [10]
- d) Decompose the problem of designing a new rice cooker using the functional decomposition approach. [10]

### Question 4

- a) What is the purpose of a reference concept in the concept selection process? [1]
- b) The concept screening process carried out by the product development team of a particular company yielded the concept scoring matrix shown in Table Q4b, complete the matrix and recommend the best concept for further development to the team. [16]

*Table Q4b: Concept scoring matrix*

		Concept							
		A (Reference) Master Cylinder		DF Lever Stop		E Swash Ring		G+ Dial Screw+	
Selection Criteria	Weight	Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score
Ease of handling	5%	3		3		4		4	
Ease of use	15%	3		4		4		3	
Readability of settings	10%	2		3		5		5	
Dose metering accuracy	25%	3		3		2		3	
Durability	15%	2		5		4		3	
Ease of manufacture	20%	3		3		2		2	
Portability	10%	3		3		3		3	
	Total Score								
	Rank								
	Continue?								

- c) What are the benefits of a structured method for concept selection? [4]
- d) State any four common pitfalls in concept selection. [4]

#### Question 5

- a) Define the term '*Industrial Design*' [2]
- b) State any four (4) critical goals that industrial designers can help to achieve when developing new products. [4]
- c) Contrast modular product design with the conventional product design approach using the headlines provided under the matrix in Table Q5c. [6]

*Table Q5c: Conventional Versus Modular Product Design*

	Design Approach	Development Approach
<b>Conventional Product Design:</b> ..... .....	..... .....	..... .....
<b>Modular Product Design:</b> ..... .....	..... .....	..... .....

- d) State three (3) specific advantages that each of the following departments can achieve as a direct result of implementing modular design;
- Research and Development, [3]
  - Manufacturing, [3]
  - Procurement. [3]
- e) Identify any four (4) modularization methods used in product development. [4]

#### Question 6

- a) What is Intellectual Property (IP)? [2]
- b) State and explain, with the aid of examples, two classes of IP. [8]
- c) Identify any three (3) driving forces for innovation. [3]

d) The transformation process from the idea to the realization of the innovation undergoes through three critical milestones (CM). Briefly explain, with the aid of a simple sketch, the processes that take place at each of the three (3) critical milestones;

- i. Critical Milestone 1 (CM<sub>1</sub>) [4]
- ii. Critical Milestone 2 (CM<sub>2</sub>) [4]
- iii. Critical Milestone 3 (CM<sub>3</sub>) [4]

End of Examination