

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY FACULTY OF INDUSTRIAL TECHNOLOGY DEPARTMENT OF INDUSTRIAL AND TECHNOLOGY

Bachelor of Engineering Honours Degree Industrial and Manufacturing Engineering

INTRODUCTION TO INDUSTRIAL ENGINEERING

TIE 1105

First Semester Examination Paper

December 2014

This examination paper consists of 5 pages

| Time Allowed: | 3 hours |
|-----------------------|------------------------------|
| Total Marks: | 100 |
| Special Requirements: | None |
| Examiner's Name: | Eng. Sipiwe Trinity Nyadongo |
| | |

INSTRUCTIONS AND INFORMATION TO CANDIDATE

- 1. Answer any five (5) questions
- 2. Each question carries 20 marks
- 3. Use of calculators is permissible

MARK ALLOCATION

| QUESTION | MARKS |
|----------|-------|
| 1. | 20 |
| 2. | 20 |
| 3. | 20 |
| 4. | 20 |
| 5. | 20 |
| 6. | 20 |
| 7. | 20 |
| TOTAL | 100 |

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Question 1

You are a representative of the Faculty of Industrial Technology at a Career Guidance Fair, and have been asked to give a talk on the engineering disciplines (except Industrial and Manufacturing Engineering) in the Faculty. Give a presentation on any three of the engineering disciplines in the Faculty in such a way as to convince the hearers to consider taking up one of the disciplines. Include in the presentation:

| i. | The definition, | [3] |
|------|---|-----|
| ii. | Job description – (mention 3 components), | [9] |
| iii. | Career paths (mention 2 for each), and | [6] |

iv. Relevant industries of work. (mention 2 for each) [2]

Question 2

a) Compute the multifactor productivity measure for each of the weeks shown in Table Q2 for production of chocolate bars. Assume 40hr weeks and an hourly rate of \$12. Overhead is 1.5 times weekly labor cost. Material cost is \$6/kg. Standard price is \$10/unit. [8]

| Week | Output (units) | Workers | Material (kg) | | |
|------|-------------------|---------|------------------|--|--|
| 1 | 30000 | 6 | 450 | | |
| 2 | 33600 | 7 | 470 | | |
| 3 | 32200 | 7 | 460 | | |
| 4 | 35400 | 8 | 480 | | |

Table Q2 – Chocolate Bar Production

- b) Hazel had worked for Dynasty Company for almost 15 years. When the CEO decided to downsize the company, she together with 399 other employees lost their jobs. She tried to find a job after that but had no success. She discovered that she could mow the neighbours' lawns for a fee. She then embarked on this business which was slow at the beginning but soon she got more orders, had to hire 2 workers to assist her and even improved on the number of services that she was offering to her customers. Hazel would like to increase her profits but she doesn't believe that it would be wise to raise her prices considering the current economic state. Instead she has given some thought to increasing productivity.
 - i) Explain using examples how increased productivity could be an alternative to increased prices. [8]
 - ii) What are some ways that Hazel could use to increase productivity? [4]

Page 2 of 5

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Question 3

Using Appendix 1, develop a two-handed processes chart for the assembly of the bolt and nut in Figure Q3. Include illustrations of the work area arrangement [20]



FIGURE Q3 - NUT AND BOLT ARRANGEMENT

[4]

[8]

Question 4

- a) Outline the main uses of time study information.
- b) A Time Study was conducted on a job that contains four elements. The observed times and performance ratings for six cycles are shown in Table Q4 below:

| OBSERVATIONS (MINUTES PER CYCLE) | | | | | | | | |
|----------------------------------|--------|------|------|------|------|------|------|--|
| Element Performance | | 1 | 2 | 3 | 4 | 5 | 6 | |
| | Rating | | | | | | | |
| 1 | 80 | 1.44 | 1.50 | 1.43 | 1.45 | 1.48 | 1.46 | |
| 2 | 90 | 5.50 | 5.54 | 5.47 | 4.51 | 5.49 | 5.52 | |
| 3 | 110% | 3.84 | 3.89 | 3.77 | 3.83 | 3.85 | 3.80 | |
| 4 | 120% | 4.10 | 4.14 | 5.08 | 4.20 | 4.16 | 4.26 | |

TABLE Q4: TIME STUDY OBSERVATIONS

i. Determine the average cycle time for each element. [4]

ii. Find the normal time for each element.

iii. Assuming an allowance factor of 15 percent of job time, compute the standard time for this job [4]

Question 5

a) As an Industrial Engineer at Drew Todd Wire Manufacturing Company briefly explain the activities that you will be involved in. [8]

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| b) | An Industrial Engineer has many career paths. To show your understanding, elaborate of the following career paths: | | | | | | | | |
|----|--|-----|--|--|--|--|--|--|--|
| | i) Lecturer, | [3] | | | | | | | |
| | ii) Production and Operations Manager, | [3] | | | | | | | |
| | iii) Inventory Manager, | [3] | | | | | | | |
| | iv) Manufacturing Engineer. | [3] | | | | | | | |
| | | | | | | | | | |

Question 6

| a) | a) Discuss Process Charts as a type of recording in Method Study: | | | | | | | |
|---|---|--|-----|--|--|--|--|--|
| b) Show the process flow chart for the following symbols: | | | | | | | | |
| | i. | Move material by truck, | [2] | | | | | |
| | ii. | [2] | | | | | | |
| | iii. | Examine material for quality, | [2] | | | | | |
| | iv. | Material in truck waiting to be processed. | [2] | | | | | |

Question 7

| a) | Explain five (5) factors that influence task learning. | [10] |
|----|--|------|
| b) | List five (5) useful applications of learning curve theory | [5] |

- b) List five (5) useful applications of learning curve theory
- A manager wants to determine an appropriate learning rate for a new type of work his c) firm will undertake. He has obtained completion times for the initial six repetitions of a job of this type as shown in Table 7. What learning rate is appropriate? [5]

Table Q7 - COMPLETION TIMES FOR JOBS

| Unit | Completion Time /Hours |
|------|-------------------------------|
| 1 | 15.9 |
| 2 | 12.0 |
| 3 | 10.1 |
| 4 | 9.1 |
| 5 | 8.4 |
| 6 | 7.4 |

END OF EXAMINATION

| Left Hand | | | | | | Right Hand | | | | | |
|-----------|----------|------------------|-----------|--------------------|-----------|------------------|---------------|--------------------|---|----------|---|
| | Distance | \bigcirc | Î | \triangleright | Δ | $\left(\right)$ | Î | \bigtriangledown | Ο | Distance | |
| | | \bigcirc | Î | \triangleright | \square | $\left(\right)$ | Î | \bigtriangledown | Ο | | |
| | | $\left(\right)$ | Î | \triangleright | \square | $\left(\right)$ | Î | \bigtriangledown | Ο | | |
| | | $\left(\right)$ | IJ | \triangleleft | Δ | $\left(\right)$ | IJ | \bigtriangledown | Ο | | |
| | | $\left(\right)$ | IJ | \triangleleft | \square | $\left(\right)$ | IJ | \bigtriangledown | Ο | | |
| | | $\left(\right)$ | IJ | \bigtriangledown | Ο | $\left(\right)$ | IJ | \bigtriangledown | Ο | | |
| | | \bigcirc | Ĵ | \bigtriangledown | \square | $\left(\right)$ | Î | \bigtriangledown | Ο | | |
| | | \bigcirc | Ĵ | \bigtriangledown | D | $\left(\right)$ | Î | \bigtriangledown | Ο | | |
| | | \bigcirc | Ĵ | \bigtriangledown | \square | $\left(\right)$ | Î | \bigtriangledown | Ο | | |
| | | \bigcirc | Ì | \bigtriangledown | \square | $\left(\right)$ | Î | \bigtriangledown | D | | |
| | | \bigcirc | Ê | \bigtriangledown | | $\left(\right)$ | Î | \bigtriangledown | D | | |
| | | \bigcirc | Î | \bigtriangledown | | $\left(\right)$ | Î | \bigtriangledown | D | | |
| | | \bigcirc | Ì | \bigtriangledown | | $\left(\right)$ | Î | \bigtriangledown | D | | |
| | | \bigcirc | Ì | \bigtriangledown | | $\left(\right)$ | Î | \bigtriangledown | D | | |
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| | | \bigcirc | Î | \bigtriangledown | D | $\left(\right)$ | Î | \bigtriangledown | D | | |
| | | \bigcirc | Ĵ | \bigtriangledown | D | $\left(\right)$ | Î | \bigtriangledown | D | | |
| | | \bigcirc | Î | \bigtriangledown | D | $\left(\right)$ | Î | \bigtriangledown | D | | |
| | | \bigcirc | Î | \bigtriangledown | D | $\left(\right)$ | Î | \bigtriangledown | D | | |
| | | \bigcirc | Î | \bigtriangledown | D | $\left(\right)$ | Î | \bigtriangledown | D | | |
| | | \bigcirc | Î | \bigtriangledown | D | $\left(\right)$ | Î | \bigtriangledown | D | | |
| | | \bigcirc | \square | \bigtriangledown | D | \bigcirc | \Rightarrow | \bigtriangledown | D | | |
| | | \bigcirc | \square | \bigtriangledown | D | \bigcirc | \Rightarrow | \bigtriangledown | D | | |
| | | \bigcirc | \square | \bigtriangledown | D | \bigcirc | \Rightarrow | \bigtriangledown | D | | |
| | | \bigcirc | \square | \bigtriangledown | D | \bigcirc | Î | \bigtriangledown | D | | |
| | | \bigcirc | Î | \bigtriangledown | D | $\left(\right)$ | Î | \bigtriangledown | Ο | | |
| | | \bigcirc | \square | \bigtriangledown | | \bigcirc | \Rightarrow | \bigtriangledown | D | | |
| | | \bigcirc | \square | \bigtriangledown | | \bigcirc | \Rightarrow | \bigtriangledown | D | | |
| | | \bigcirc | \square | \bigtriangledown | | \bigcirc | \Rightarrow | \bigtriangledown | D | | |
| | | \bigcirc | \square | \bigtriangledown | | \bigcirc | \Rightarrow | \bigtriangledown | D | | |
| | | \bigcirc | \square | \bigtriangledown | | \bigcirc | \Rightarrow | \bigtriangledown | D | | |
| | | \bigcirc | \square | \bigtriangledown | | \bigcirc | \Rightarrow | \bigtriangledown | D | | |
| | | | | | | | | | | | • |

Appendix 1 – Two-Handed Process Chart

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