



**PROGRAM** : NATIONAL DIPLOMA  
*ENGINEERING: INDUSTRIAL*

**SUBJECT** : **FACILITY LAY-OUT DESIGN AND  
MATERIAL HANDLING**

**CODE** : **BFM 2111**

**DATE** : 8<sup>th</sup> JUNE 2019  
: JUNE EXAMINATION

**DURATION** : 08:30 - 11:30

**WEIGHT** : 60 : 40

**TOTAL MARKS** : 100

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**ASSESSOR** : MR MT RAMOGAYANE

**MODERATOR** : MR R P MUTYAVAVIRE

**NUMBER OF PAGES** : PAGES 4

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**INSTRUCTIONS** : ONLY ONE POCKET CALCULATOR PER CANDIDATE  
MAY BE USED.

**REQUIREMENTS** :

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**INSTRUCTIONS TO STUDENTS**

PLEASE ANSWER ALL QUESTIONS.

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**QUESTION 1**

- 1.1 Urethane moulded products cast long pump shaft for various mines in Burgersfort. The total demand for long pump shaft in the month of June, 2011 is 20000. The company operates a 5-day week and single 8-hour shift per day. The seat production line efficiency is estimated at 75% and Break time is 30 minutes employee personal time is 15 minutes per shift. The individual work station cycle times are given in table Q1 below. Balance the production line.

Table Q1

| Work Station | Cycle Time (min) |
|--------------|------------------|
| 1            | 0.40             |
| 2            | 0.26             |
| 3            | 0.82             |
| 4            | 0.95             |
| 5            | 0.25             |

(15)

- 1.2 Compute the efficiency of the production line above.
- 1.3 Suggest one way you could improve the line efficiency at minimal cost.

(3)

(2)

**[20]**

**QUESTION 2****Case study:**

An insurance company conducted market research and concluded that a branch in Everton would need to award 200 funeral policies to its clients per day. Currently 4 field consultants go into the community and sell a funeral policy by having a prospective client fill out a paper application form. It takes a field agent 5 min to complete a single applications. Assume 8 hour shift with 30 minutes lunch and two -15 minutes mini-breaks.

At the branch a single capturer will take the application forms and capture all the applicable information into the system. Each Form will wait for 5 minutes before it can be captured Due to the fact that field consultants miss certain important details the capturer needs to contact

the prospective client and confirm some of the detail. In total it takes 45min to capture a single application form. Due to mistakes on some application forms 10 applications are discarded per day.

At the head office in Johannesburg an Application Coordinator will monitor all the applications that are captured and submitted on the system. It takes 2 minutes to monitor As soon as the branch has submitted a form he will forward the group of forms to the Approval department by clicking the submit button again.

Due to legislative requirements every application must be approved by a Policy Approver who sits in Auckland Park, Johannesburg. It takes 15 minutes to approve a policy, compile the applicable Policy package contract and email or send sms for the confirmation of the cover. It takes 3 minutes before the policy can be approved.

- 2.1.1. Complete VSM template with all data required (5)
- 2.1.2. Taking the amount of hours available in a day and the demand that must be reached, at what pace (in min) should a policy be awarded? (5)
- 2.1.3. You have been requested by the national branch manager to advice on the amount of field consultants that would be required to achieve the sales marked out by the market research as she feels that the 4 field consultants that are currently deployed are not enough (3)
- 2.1.4. She wants to know what the total time is that it takes before a client to receive sms notification and percentage of value adding (VA %) (2)
- 2.1.5. Finally she wants to know what you would recommend as solutions to why the branch is not reaching its expected target (Apply 4<sup>th</sup> industrial revolution thinking) (5)

**[20]**

### **QUESTION 3**

- 3.1 With the aid of illustrations briefly discuss the importance of Route sheets in process design. (4)
- 3.2 A car accessories factory produces six (6) different moulded plastic parts. After moulding, the parts are taken by a conveyor through a spray painting booth and a drying oven. The company operates a single shift, five days per week. The production schedule for a particular week is illustrated in table Q3 below. Given that employee

personal time is 48 minutes, plant efficiency is 85 %, and hook spacing is 0.3m. Compute the appropriate conveyor speed to meet production demand.

Table Q3

| Part Name   | Parts per hook | Weekly Demand |
|-------------|----------------|---------------|
| Wiper arm   | 4              | 4500          |
| Wheel cove  | 10             | 2700          |
| Sun visor   | 2              | 1350          |
| Ind. lamp   | 14             | 10500         |
| Tail lamp   | 4              | 900           |
| Side mirror | 6              | 720           |

(10)

3.3.1 From the spray booth, the components pass through a backing oven. The paint needs 15mins to cure. Calculate the required length of the oven.

(3)

3.3.2 The process Engineer realises there is insufficient space to accommodate the oven as originally designed. How can he reduce the size of the oven and still achieve the desired curing time for the paint.

(3)

**[20]**

#### **QUESTION 4**

4.1 Five dissimilar parts (1, 2 . . . 5) are manufactured in one factory. The routing of the parts is illustrated in table Q4a below. Table Q4b provides production quantities and the weights for the parts. Assuming the machines are initially arranged in alphabetic order, using the **from-to chart**, determine the efficiency of this machine arrangement.

(10)

Table 4a

| Part | Routing         |
|------|-----------------|
| 1    | R A B D C F S   |
| 2    | R B D C A S     |
| 3    | R E F B A C D S |
| 4    | R F A C D S     |
| 5    | R C A D S       |

Table 4b

| Part | Qty per day | Weight (kg) |
|------|-------------|-------------|
| 1    | 2000        | 0.5         |

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|   |      |      |
|---|------|------|
| 2 | 2000 | 9.0  |
| 3 | 2000 | 0.5  |
| 4 | 2000 | 15.0 |
| 5 | 2000 | 3.75 |

- 4.2 The efficiency of the original machine arrangement in Q4.1 is considered too low and uneconomical. As an Industrial Engineer you are tasked to improve it. Propose, giving well reasons an improved machine arrangement. Prove your proposal is better.

(10)

**[20]**

### **QUESTION 5**

- 5.1 Part of the production process for a component demands that the parts are moved one at a time from a spot welding station through a spray booth to assembly. Solve the material Handling problem arising using the material handling equation. A detailed explanation of each step is required.

(10)

- 5.2 State and briefly discuss any five (5) principles of material handling.

(10)

**[20]**

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**TOTAL = 100**

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