UNIVERSITY
—OF—
JOHANNESBURG

PROGRAM	:	NATIONAL DIPLOMA *ENGINEERING: INDUSTRIAL*
SUBJECT	:	**FACILITY LAY-OUT DESIGN AND MATERIAL HANDLING**
CODE	:	**BFM 2111**
DATE	:	JUNE 2015
	:	13 JUNE 2015
DURATION	:	(SESSION 1) 08:30 - 11:30
WEIGHT	:	50 : 50
TOTAL MARKS	:	100

ASSESSOR	:	MR R P MUTYAVAVIRE
MODERATOR	:	MR S CHIKUMBA
NUMBER OF PAGES	:	PAGES 4

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

PLEASE ANSWER ALL QUESTIONS.

QUESTION 1

1.1   Masiyepambili Safety glass manufactures windscreens for variety of vehicle models. The total demand for windscreens for June, 2015 is 40000. The company operates a 5-day week and one (1) shift per day. The production line efficiency is 90% and employee personal time is 40 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
1	0.40
2	0.26
3	0.82
4	0.95
5	0.25

(15)

1.2   Calculate the efficiency of the production line illustrated in Table Q1.

(3)

1.3   Suggest how an Industrial Engineer could improve the line efficiency at minimal cost.

(2)

[20]

QUESTION 2

2.1   A company manufactures roofing sheets using a simple 3-step production process. Each process is capable of rework. Given the information in the table below, calculate the input required to satisfy an order of 1000 sheets.

Process	Defective Rate	Rework Rate
1	3%	60%
2	5%	75%
3	7%	80%

(10)

2.1.2   Given that the scrap costs for processes 1, 2 and 3 are R20, R50 and R80 respectively, calculate the total scrap costs.

(5)

2.2.1 Explain in good detail the importance of understanding the Company's Management policies prior to embarking on facility lay out design projects.

(5)

[20]

QUESTION 3

3.1 Briefly discuss the importance of Route sheets in process design.

(4)

3.2 A toy producing factory produces six (6) different moulded plastic toys. 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 60 minutes, plant efficiency is 90%, and hook spacing is 0.3m. Compute the appropriate conveyor speed to meet production demand.

Table Q3

Part Name	Parts per hook	Weekly Demand
doll	4	4500
Fire truck	10	2700
Dump truck	2	1350
Horn	14	10500
Cutlery set	4	900
Bike	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 Limpopo Engineers are manufacturing five (5) parts (1, 2 ... 5) in one of their factories. The routing of the parts is illustrated in table Q4a below. Table Q4b illustrates production quantities and the weights for the parts. 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
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 required to improve it. Propose, giving good reasons, an improved machine arrangement. Prove your proposal is better.

(10)

[20]

QUESTION 5

5.1 A small sized engineering forge shop consists of five (5) main divisions. Space requirements for each of these are specified in table Q5a below. The respective departmental activity relationships are illustrated in table Q5b.

Table 5a

Department	Area (sq m)
1.Body shop	12 000
2.Engine bay	1 000
3.Spray booth	2 000
4.Quality control	3 000
5.Chassis alignment	6 000

	1	2	3	4	5
	E4	A1	A2	I	1
		O	E	I	2
			I		3
				A1	4
					5

Table 5b

5.2   Develop a worksheet and the respective dimensionless block diagram based on the Activity Relationship Chart in table Q5b.

(10)

5.3   Fit the divisions into a standard workshop measuring 200m x 150m.
Provide for 20m wide aisles in-between the divisions.

(10)

[20]

TOTAL = 100