



PROGRAM : NATIONAL DIPLOMA
INDUSTRIAL ENGINEERING TECHNOLOGY

SUBJECT : **WORK STUDY 2**

CODE : **TIV 231**

DATE : SUPPLEMENTARY EXAMINATION
18 JULY 2018

WEIGHT : 40:60

DURATION : 11:30 – 14:30

TOTAL MARKS : 100

EXAMINER : Y. MAWANE

MODERATOR : T. MOKGOKONG

NUMBER OF PAGES : 3 PAGES

INSTRUCTIONS

1. WRITE LEGIBLY AND ANSWER IN A POINT WISE MANNER. MARKS WILL BE FORFEITED IF YOUR HANDWRITING IS NOT LEGIBLE.
2. ANSWER ALL QUESTIONS.
3. ONE CALCULATOR PERMITTED PER STUDENT.

QUESTION 1

1.1 Draw a single column process chart for the following process.

An applicant takes a number on arrival and seats to wait until the number is called. When called the applicant goes to the first workstation where the application form is reviewed. After reviewing the applicant goes to the next station where testing of eyes is performed. Once the testing of eyes is completed, the applicant goes to wait at the next station. The applicant is called again and the file is checked for any violations and restrictions. The applicant goes to wait at the next station, where fees are paid. (15)

1.2 Describe the five (5) rules for brainstorming. (5)

1.3 Name five (5) advantages of an open plan layout. (5)

[25]

QUESTION 2

2.1 Read the following case study and develop a SWOT analysis.

Anytime cakes is a bakery shop in Isando that sells different type of fresh cookies as well as pies. Their food is of high quality, healthy and a convenient option. The management team has different expertise e.g. catering, marketing and accounting. The company is planning to open another location in downtown Johannesburg (this area is growing at 5% per annum). They are focused on developing a business model that will make it easy to grow quickly and that opens up the possibility of franchising. However, they need more capital on this venture. The company is reasonably new and there are many other food providers in that area. Customers expect excellent service from the food providers. (13)

2.2 Make two suggestions to improve the probability for success based on the SWOT Analysis (2)

2.3 A plastic extruder has an auxiliary time of 5%. The machine working time is 90% and idle time is 10%. The company has two, nine-hour shifts. The number of components produced by the machine is 95 components with a standard time of 10mins/part.

Determine the following:

2.3.1 Machine available time (2)

2.3.2 Machine running time (2)

2.3.3 Machine running time at standard (2)

2.3.4 Machine efficiency index (2)

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- 2.3.5 Machine effective utilization index (2)
[25]
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QUESTION 3

- 3.1 Develop an MTM-1 analysis for a process of packing a mixed box of stationary. The operator takes a box of red pens (40cm) and places it in the box in front of him (24cm). He position the pens in the box so that he can neatly pack all the stationary into the box. The operator then gets a box of blue pens and places it in the box (30cm). (13)
- 3.2 A company would like to evaluate four bonus schemes. Employees work for 25 hours/week. Each employee is expected to complete 500 pieces in 22 hours and the hourly rate is R110.
Calculate the bonus and total earnings for the following schemes:
- 3.1.1 Guaranteed scheme (3)
3.1.2 Halsey premium bonus scheme (3)
3.1.3 Halsey-Weir scheme (3)
3.1.4 Rowan scheme (3)
[25]
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QUESTION 4

- 4.1 Develop a two handed process chart for the following process:
A nurse is giving an injection to a patient. She takes a syringe with her right hand and takes the medication with the left hand. She fills the syringe using both hands. She pushes any air bubbles out with the right hand. She places the syringe and medicine on the table. She takes a cleaning swab with her right hand and she opens it using both hands. She cleans the patients arm with the swab using her right hand and left hand holds the package. She discards the package and swab. She injects the patient, with the right hand holding the syringe and the left hand holding the arm. She places the syringe on the medical waste container with the right hand. Finally, she gives a plaster to the patient with the right hand. (18)
- 4.2 Lists seven (7) benefits for nominal group technique. (7)
[25]
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TOTAL MARKS: 100

Methods-Time Measurement application data in tmu (Based metric weights and measures)

REACH — R

Distance (cm)	Time (tmu)				Hand in motion		Case and description
	A	B	C or D	E	A	B	
2 or less	2.0	2.0	2.0	2.0	1.6	1.6	A. Reach to object in fixed location, or to object in other hand or on which other hand rests
4	3.4	3.4	5.1	3.2	3.0	2.4	
6	4.5	4.5	6.5	4.4	3.9	3.1	
8	5.5	5.5	7.5	5.5	4.6	3.7	
10	6.1	6.3	8.4	6.8	4.9	4.3	
12	6.4	7.4	9.1	7.3	5.2	4.8	B. Reach to single object in location which may vary slightly from cycle to cycle
14	6.8	8.2	9.7	7.8	5.5	5.4	
16	7.1	8.8	10.3	8.2	5.8	5.9	
18	7.5	9.4	10.8	8.7	6.1	6.5	
20	7.8	10.0	11.4	9.2	6.5	7.1	
22	8.1	10.5	11.9	9.7	6.8	7.7	C. Reach to object jumbled with other objects in a group so that search and select occur
24	8.5	11.1	12.5	10.2	7.1	8.2	
26	8.8	11.7	13.0	10.7	7.4	8.8	
28	9.2	12.2	13.6	11.2	7.7	9.4	
30	9.5	12.8	14.1	11.7	8.0	9.9	
35	10.4	14.2	15.5	12.9	8.8	11.4	D. Reach to a very small object or where accurate grasp is required
40	11.3	15.6	16.8	14.1	9.6	12.8	
45	12.1	17.0	18.2	15.3	10.4	14.2	
50	13.0	18.4	19.6	16.5	11.2	15.7	
55	13.9	19.8	20.9	17.8	12.0	17.1	
60	14.7	21.2	22.3	19.0	12.8	18.5	E. Reach to indefinite location to get hand in position for body balance or next motion or out of way
65	15.6	22.6	23.6	20.2	13.5	19.9	
70	16.5	24.1	25.0	21.4	14.3	21.4	
75	17.3	25.5	26.4	22.6	15.1	22.8	
80	18.2	26.9	27.7	23.9	15.9	24.2	

MOVE — M

Distance (cm)	Time (tmu)				Wt allowance			Case and description
	A	B	C	Hand in motion B	Weight (kg) up to	Static constant (tmu)	Dynamic factor	
2 or less	2.0	2.0	2.0	1.7	1	0	1.00	A. Move object against stop or to other hand
4	3.1	4.0	4.5	2.8				
6	4.1	5.0	5.8	3.1				
8	5.1	5.9	6.9	3.7	2	1.6	1.04	
10	6.0	6.8	7.9	4.3				
					4	2.8	1.07	
12	6.9	7.7	8.8	4.9				
14	7.7	8.5	9.8	5.4				
16	8.3	9.2	10.5	6.0	6	4.3	1.12	
18	9.0	9.8	11.1	6.5				
20	9.6	10.5	11.7	7.1				
					8	5.8	1.17	B. Move object to approximate or indefinite location
22	10.2	11.2	12.4	7.6				
24	10.8	11.8	13.0	8.2	10	7.3	1.22	
26	11.5	12.3	13.7	8.7				
28	12.1	12.8	14.4	9.3				
30	12.7	13.3	15.1	9.8	12	8.8	1.27	
35	14.3	14.5	16.8	11.2	14	10.4	1.32	
40	15.8	15.6	18.5	12.6				
45	17.4	16.8	20.1	14.0				
50	19.0	18.0	21.8	15.4	16	11.9	1.36	C. Move object to exact location
55	20.5	19.2	23.5	16.8				
					18	13.4	1.41	
60	22.1	20.4	25.2	18.2				
65	23.6	21.6	26.9	19.5				
70	25.2	22.8	28.6	20.9	20	14.9	1.46	
75	26.7	24.0	30.3	22.3				
80	28.3	25.2	32.0	23.7				
					22	16.4	1.51	

GRASP — G

Case	Time (tmu)	Description
1A	2.0	Pick up grasp — small, medium or large object by itself, easily grasped
1B	3.5	Very small object or object lying close against a flat surface
1C1	7.3	Interference with grasp on bottom and one side of nearly cylindrical object. Diameter larger than 12 mm
1C2	8.7	Interference with grasp on bottom and one side of nearly cylindrical object. Diameter 6 to 12 mm
1C3	10.8	Interference with grasp on bottom and one side of nearly cylindrical object. Diameter less than 6 mm
2	5.6	Regrasp
3	5.6	Transfer grasp
4A	7.3	Object jumbled with other objects so search and select occur. Larger than 25×25×25 mm
4B	9.1	Object jumbled with other objects so search and select occur. 6×6×3 mm to 25×25×25 mm
4C	12.9	Object jumbled with other objects so search and select occur. Smaller than 6×6×3 mm
5	0	Contact, sliding or hook grasp

POSITION — P*

Class of fit	Symmetry	Easy to handle	Difficult to handle
1. Loose — No pressure required	S	5.6	11.2
	SS	9.1	14.7
	NS	10.4	16.0
2. Close — Light pressure required	S	16.2	21.8
	SS	19.7	25.3
	NS	21.0	26.6
3. Exact — Heavy pressure required	S	43.0	48.6
	SS	46.5	52.1
	NS	47.8	53.4

*Distance moved to engage — max. 25 mm.

RELEASE - RL

Case	Time (tmu)	Description
1	2.0	Normal release performed by opening fingers as independent motion
2	0	Contact release

DISENGAGE — D

Class of fit	Easy to handle	Difficult to handle
1. Loose — Very slight effort, blends with subsequent move	4.0	5.7
2. Close — Normal effort, slight recoil	7.5	11.8
3. Tight — Considerable effort, hand recoils markedly	22.9	34.7

EYE TRAVEL and EYE FOCUS — ET and EF

Eye travel time = $15.2 \times \frac{T}{D}$ tmu, with a maximum value of 20 tmu

where T = the distance between points from and to which the eye travels,
D = the perpendicular distance from the eye to the line of travel T.

Eye focus time = 7.3 tmu.

TURN — T

Weight (kg)	Time (tmu) for degrees turned										
	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°
Small (0) to (1)	2.8	3.5	4.1	4.8	5.4	6.1	6.8	7.4	8.1	8.7	9.4
Medium (1) to (5)	4.4	5.5	6.5	7.5	8.5	9.6	10.6	11.6	12.7	13.7	14.8
Large (5.1) to (16)	8.4	10.5	12.3	14.4	16.2	18.3	20.4	22.2	24.3	26.1	28.2

APPLY PRESSURE — AP

Full cycle			Components		
Symbol	tmu	Description	Symbol	tmu	Description
APA	10.6	AF + DM + RLF	AF	3.4	Apply force
			DM	4.2	Dwell, minimum
APB	16.2	APA + G2	RLF	3.0	Release force

BODY, LEG AND FOOT MOTIONS

Description	Symbol	Distance	Time (tmu)
Foot motion — Hinged at ankle	FM	Up to 10 cm	8.5
With heavy pressure	FMP		19.1
Leg or foreleg motion	LM-	Up to 15 cm	7.1
		Each extra cm	0.5
Sidestep — Case 1 — Complete when leading leg contacts floor	SS-C1	Less than 30 cm	Use REACH or MOVE time
		30 cm	17.0
		Each extra cm	0.2
Case 2 — Lagging leg must contact floor before next motion can be made	SS-C2	Up to 30 cm	34.1
		Each extra cm	0.4
Bend, stoop, or kneel on one knee	B.S KOK		29.0
Arise	AB. AS. AKOK		31.9
Kneel on floor — both knees	KBK		69.4
Arise	AKBK		76.7
Sit	SIT		34.7
Stand from sitting position	STD		43.3
Turn body 45 to 90 degrees:			
Case 1 — Complete when leading leg contacts floor	TBC1		18.2
Case 2 — Lagging leg must contact floor before next motion can be made	TBC2		37.2
Walk	W-M	Per metre	17.4
Walk	W-P	Per pace	15.0
Walk — obstructed	W-PO	Per pace	17.0