



PROGRAM : NATIONAL DIPLOMA
INDUSTRIAL ENGINEERING TECHNOLOGY

SUBJECT : WORK STUDY 2

CODE : TIV 231

DATE : WINTER EXAMINATION
1 JUNE 2018

WEIGHT : 40:60

DURATION : 08:30 – 11:30

TOTAL MARKS : 100

EXAMINER : Y. MAWANE

MODERATOR : T. MOKGOKONG

NUMBER OF PAGES : 4 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 Briefly define predetermined time standards (PTS). (3)
- 1.2 List six (6) disadvantages of the PTS system. (6)
- 1.3 Develop an MTM-1 analysis for the tagging of the four-legged lifting system using the tables attached and find the total tmu (time).

The worker reaches for the tag for the four-legged lifting system. The tag is placed in a container 6cm away from the workstation. He then reaches for the plastic thread placed 10cm away from the working place in a packet. Assembles thread with the chain and tag. He tightens the thread and cut the thread. (16)

[25]

QUESTION 2

- 2.1 Method study can improve efficiency in various directions.
Lists five (5) directions in which method study can improve efficiency. (5)
- 2.2 Briefly define two handed process chart. (2)
- 2.3 Draw a two handed process chart for the following process:
An operator grasp a hook with the left hand while grasping the chain with the right hand. Bring both hook and chain together and align hook and chain. Both hands place the aligned chain and hook on the floor. The right hand grasp a pin and positions it to the hole. The left hand grasps the hammer while right hand is positioning the pin. The left hand hammers the pin. (18)

[25]

QUESTION 3

- 3.1 A company would like to evaluate four bonus schemes. Employees work for 40 hours/week. Each employee works 38 hours and the hourly rate is R85. Each employee needs to complete 1200 pieces/week.

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 (4)
- 3.2 Which scheme would you recommend? Explain. (2)

- 3.3 An operator produces 200 pieces/day. The standard time for an operation is 2 minutes/piece. The operator has 8 hours working day and 40 minutes waiting time during the day. The operator has a base rate of R110 per hour.

You are required to calculate the following:

- 3.3.1 Standard hours earned (2)
- 3.3.2 Operators efficiency (2)
- 3.3.3 Direct labour cost per piece at this efficiency (2)
- 3.3.4 Labour utilization (2)
- 3.3.5 Labour productivity (2)

[25]

QUESTION 4

- 4.1 Draw a multi activity chart for the following process:

Worker 1 fetches the grade 10 chain from shelf (30 seconds), while worker 2 prepares the rubber (10 seconds). Worker 2 puts the chain on top of the rubber (5 seconds); worker 1 prepares the grinder machine (15 seconds). The inspector inspects the chains and marks it off where it's supposed to be cut with correct measurements (35 seconds). Worker 1 cuts the chain using the grinder (5 seconds); worker 2 fetches the hooks (5 seconds) and worker 2 prepares the hooks for assembling (5 seconds). Worker 1 assembles the chains and hooks for 15 seconds. Inspector comes to check the assembling (45 seconds). (15)

- 4.2 A cause and effect diagram is a visualization tool for categorizing the potential causes of a problem in order to identify its root causes.

Draw a cause and effect diagram for the following problem:

One of the branch offices is uncooperative and a senior manager has decided to investigate the situation. He found that the site, the branch was located in was in a rundown area, the building itself was spacious and friendly but the surrounding area had a high crime rate and was rather depressing. The equipment at the branch was reasonably modern, however, they have been experiencing challenges with their e-mail system. The system was down for a significant period. It was also found that, some staff members were demotivated and capable only when supervised closely although some members were efficient and productive. The branch manager had several urgent tasks to complete which prevented contact with the head office and had missed the last

branch managers meeting. The work done by the branch was mainly good but some sales had declined recently, probably due to the area it is situated in.

(10)

[25]

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