



PROGRAM : NATIONAL DIPLOMA
INDUSTRIAL ENGINEERING TECHNOLOGY

SUBJECT : **ENGINEERING WORK STUDY II**

CODE : **TIV 231**

DATE : WINTER SSA EXAMINATION 2015
15 JULY 2015

DURATION : (SESSION 2) 11:30 - 14:30

WEIGHT : 50 : 50

TOTAL MARKS : 101

EXAMINER : R STEENKAMP

MODERATOR : G DE CLERCQ

NUMBER OF PAGES : 4 PAGES
ANNEXURE 4 PAGES

REQUIREMENTS : STUDENTS MAY USE CALCULATOR

INSTRUCTIONS TO CANDIDATES:

PLEASE ANSWER ALL THE QUESTIONS.

QUESTION 1

- 1.1. When tools and equipment is designed there are certain principles of motion economy to take into consideration name any 5. (5)
- 1.2. Define activity sampling and explain why we use it. (5)
- 1.3. Name five Value Engineering techniques (5)
- 1.4. What are the five symbols used in a process chart and what does each stand for? (5)
- 1.5. Name the four auxiliary tasks most often combined with production. (4)
- 1.6. Why is implementation and maintenance of a new improved method critical? (2)

[26]

QUESTION 2

Draw a multiple activity chart of the following slitting fabric process. The operator runs the machine for 2 minutes. The machine slits the fabric (2min). During this time the helper gets the wrappers and labels (1 min). Once the machines finishes the helper wraps rolls while the operator waits (1 min). Then the operator labels the rolls (1min) he then opens the winder (0.5min). The helper then removes the rolls (1 min). While the helper places the rolls on the skid the operator starts the machine again.

[12]

QUESTION 3

Pineapple express has decided to offer bonuses to their worker as a motivational tool. The management has approached you to determine which system would be best for them to use considering that they want to minimize expenses. The company works a 40-hour work week, if a worker completes the work in 36 hours calculate the Bonus and the Total Earning for each of the following schemes. The hourly pay is R110.

Determine the bonus and total earnings for each of the following:

- 5.1 The Guaranteed scheme (3)
- 5.2 The Halsey scheme (3)
- 5.3 The Halsey-Wair scheme (3)
- 5.4 The Rowan scheme (3)
- 5.5 Which scheme would you advise the company to use and why? (1)

[13]

QUESTION 4

Apply the PTS system to the following actions. What are the actions and times required and what is the total tmu.

A nurse is giving an injection to a patient. She has already opened the packet for the syringe and the cleaning swab. She reaches for a syringe 45cm away and she reaches for the medication (30 cm) and draws the medication into the syringe by inserting the syringe needle into the medication bottle and moving the plunger 2cm she then removes the syringe from the bottle (4cm) and she then places the medication bottle on the work surface 45cm. The process ends with the syringe in her hand.

[10]

QUESTION 5

Draw a Cause and effect Diagram of the following case study. A team got together to discuss causes of poor petrol usage. They found that the way people drive has a huge impact on the amount of petrol people use. Those who drive too fast and use incorrect gears increase their petrol usage. Other poor driving habits also have a negative effect on petrol usage. Vehicles that are not properly maintained use more petrol. If the incorrect octane of petrol is used it also increases the amount of petrol used. Lubrication is also important in petrol usage if it is not done correctly petrol usage increases. Underinflated tires have a negative effect on petrol usage as does the incorrect carburetor adjustment.

[10]

QUESTION 6

The utilization of a CNC machine was recorded using the activity sampling technique. In total 100 observations were made and the observations were conducted over two 8 hour shifts. Working time is 80%. The number of components produced by the machine in the two shifts is 650 with the Standard time 1.5s. The machine auxiliary time is 6%.

- 3.1 Determine the machine available time. (2)
- 3.2 Determine the machine running time. (2)
- 3.3 Determine the machine utilization index. (2)
- 3.4 Determine the machines running time at standard (2)
- 3.5 Determine the machine efficiency index (2)
- 3.6 Determine the machine effective utilization index. (2)

[12]

QUESTION 7

Farm workers have to remove weeds from between tea bushes. They need to spend most of the time on their knees and pull out the weeds. What do you need to do from an ergonomic point of view to ensure that they can perform well and not be injured or exhausted?

[6]

QUESTION 8

Draw an X-chart from the following two forms; Application for car insurance and change form.

Application											
ID number											
Surname _____											
First names _____											
Telephone _____											
Cell No _____											
Car make _____											
Car model _____											
Year of manufacture _____											
Colour of the vehicle _____											
Mileage of the vehicle _____											

Application to change details of vehicle											
Surname _____											
First Name _____											
Policy number											
Reason for change _____											
Car make _____											
Car model _____											
Year of manufacture _____											
Colour of the vehicle _____											
Mileage of the vehicle _____											

[12]

TOTAL : 101
FULL MARKS : 100

Table 24. Methods-Time Measurement application data in tmu (Based metric weights and measures)

I. 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	

INTRODUCTION TO WORK STUDY

II. MOVE—M

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

III. TURN—T

Weight (kg)	Time (min) 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

IV. APPLY PRESSURE—AP

Full cycle	Components			Description	Time	Description
	Symbol	Time	Symbol			
APA	10.6	AF + DM + RLF	AP	3.4	Apply force	
APS	16.2	APA + G2	DN	4.2	Dwell, minimum	
			RLF	3.6	Reverse force	

INTRODUCTION TO WORK STUDY

IV. GRASP — G

Case	Time (min)	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 end 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

V. POSITION — P

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

*Distance measured to weight — min. 25 mm.

VI. RELEASE — R1

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

VII. 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

VIII. EYE TRAVEL and EYE FOCUS — ET and EF

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

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 min.

X. **SIMULTANEOUS MOTIONS**

REACH	MOVE	GRASP	POSITION	EXTEND GAUGE	
A E	B	G1A G2 G3	P15 P25 P35	D2 D1E D1D	
A E	B	G1A G2 G3	P15 P25 P35	D2 D1E D1D	REACH
A E	B	G1A G2 G3	P15 P25 P35	D2 D1E D1D	MOVE
A E	B	G1A G2 G3	P15 P25 P35	D2 D1E D1D	GRASP
A E	B	G1A G2 G3	P15 P25 P35	D2 D1E D1D	POSITION
A E	B	G1A G2 G3	P15 P25 P35	D2 D1E D1D	DISENGAGE

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