PRINCE OF SONGKLA UNIVERSITY

FACULTY OF ENGINEERING

Final Examination : Semester I **Academic Year** : 2006

Date : October 2, 2006 **Time** : 13:30 - 16:30

Subject : 225 - 344 Work Study and Industrial Plant **Room** : A401

ทุจริตในการสอบ โทษขั้นต่ำปรับตกในรายวิชานั้น และพักการเรียน 1 ภาคการศึกษา

Directions:

1. The following materials can be led into examination room :
   - Lecture notes, handouts, or textbooks.
   - Electronic handheld calculator and Electronic dictionary.
2. You must answers ALL questions.
3. You must fill your name and ID code on this page, and fill only your name on the top-right corner of the other pages.
4. This exam composes of two parts. The second part is divided into 5 problems.

First name Mr./Miss ..... Last name .....

Student ID .....

Score (fill by lecturer)

Problem	points	Your points
Part I	8	
Part II		
1	5	
2	3	
3	9	
4	5	
5	5	
	35	

*** This material is prepared by Asst. Prof. Charoen Jaitwijitra ***

Name .....

Part I – (8 points) Matching. Next to each definition in column A, place the best term (letter only) from column B. The same answer can be used more than once, or none may apply (then use letter X).

Column A		Column B
	1. The elemental time obtained either directly or by subtracting successive watch time	A effective time
	2. What type of allowances that should not be included in standard time?	B ineffective time
	3. Worker goes to drink on working hour	C observed time
	4. Sum of foreign element times =	D fatigue
	5. Representative time derived from elemental times	E foreign element
	6. Sum of all observed times =	F motion study
	7. Any cessation in the work routine that does not occur in the typical work cycle	G normal time
	8. A lessening in the capacity to work	H qualified worker
	9. Time the worker is not working	I extra allowance
	10. An interruption in the regular work cycle	J avoidable delays
	11. A worker who can achieve the established standard of performance when following the prescribed method and working at an average pace	K check time
	12. Bad light at a work place	L idle time
	13. Observed time multiply by rating =	M personal needs allowance
	14. Sum of TEBS and TEAF	N constant element
	15. An interruption in the continuity of an operation that is beyond the control of an operator	O unaccounted time
		P variable allowances
		Q rating factor
		R performance rating
		S Selected time
		T standard time
		X none apply

Name .....

Part II- (5 problems worth 20 points)

1. (5 points) The times of element #1 which were obtained by the direct time study technique for five cycles are as the following; 0.14, 0.19, 0.17, 0.20, and 0.15 minutes respectively. The standard deviation of this distribution is known to be $\sigma = .0068$. Assume the time study procedure has no bias. Determine a 99% confidence interval for the true mean (μ).

2. (3 points) Compute the interference delay time **in the unit of minutes** by using the following expression:

$$I = 50\left(\sqrt{(1+X-N)^2+2N}-(1+X-N)\right)$$

Where I = interference, expressed as a percentage of the mean attention time.
X = ratio of mean machine running time to mean machine attention time.
N = number of machine units assigned to one operator.

There are twenty units of machine with 120 minutes mean running time, and attention time is 3 minutes.

Name .....

3. A time study of a certain operation obtains the following data:

	Element					
	1		2		3	
Cycle	W	OT	W	OT	W	OT
1	67	67	78	11	97	19
2	152	55	161	9	186	25
3	270	84	285	15	307	22
4	379	72	391	12	411	20
5	481	70	499	18	595	?

Where R is rating factor in percent,
W is watch time, 1/100 minutes,
OT is observed time, 1/100 minutes,
NT is normal time, 1/1000 minutes.

3.1. (1 point) A foreign element is occurred after completed the element 2 in the fifth cycle. It started from 4.99 to 5.74 minutes. Compute OT for element 3 in the fifth cycle.

3.2. (3 points) If the values 113, 105, and 120 are assigned for rating factors of element 1 to 3 respectively, compute average normal times for each element.

	Element		
	1	2	3
Total OT	.....	.....	.....
Rating	.....	.....	.....
Total NT	.....	.....	.....
Average NT	.....	.....	.....

3.3. (5 points) If the elapsed time is 6.12 minutes, TEBS = 0, TEAF = 0.12 minutes, compute unaccounted time and recording error in percent. The effective time is assumed to be 5.22 minutes.

4. (5 points) To get ± 5 percent precision on work that is estimated to take 80 percent of the worker's time, how many random observations are required at the 97.56 percent confidence level?

Name .....

5. (5 points) The following table shows details about work sampling data collected by a work study analyst. He observed whether the lathes working or not for ten days. Compute the UCL and LCL of the ratio of idle **for day 3** using $\pm 2\sigma$.

Day	Number of observations	Number of Idles found	Ratio
1	33	6	0.182
2	52	9	0.173
3	53	4	0.075
4	51	9	0.176
5	36	11	0.306
6	45	8	0.178
7	38	5	0.132
8	49	10	0.204
9	51	14	0.275
10	42	11	0.262
Sum	450	87	