Prince of Songkla University
Faculty of Engineering

Final Examination: Second Semester **Academic year: 2005**
Date: February 27, 2006 **Time: 13:30 - 16:30**
Course: 226-443 Ergonomics **Room: R300**

Instruction

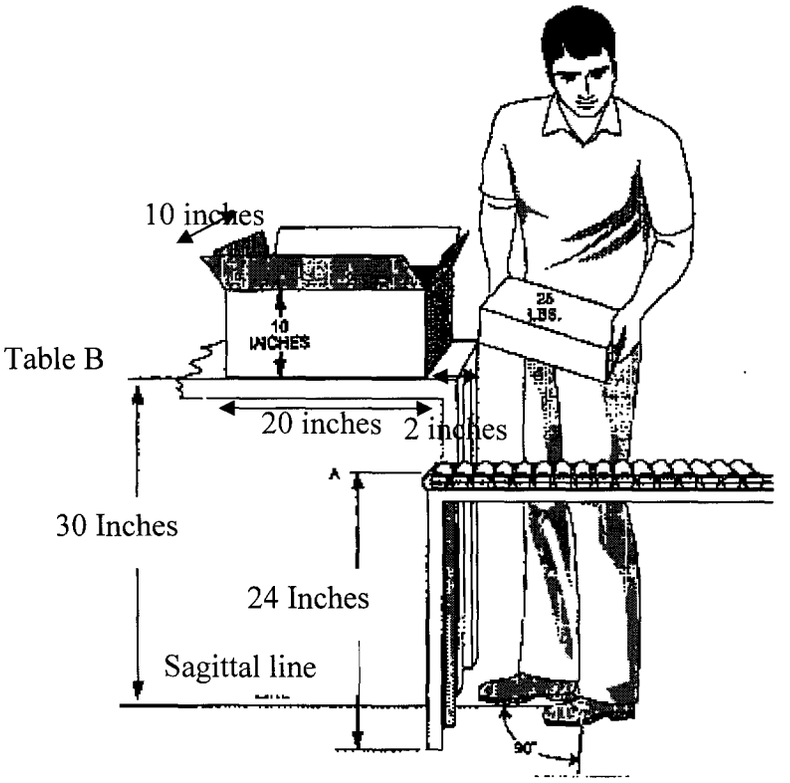
1. This is a closed book exam.
2. Only one sheet of notes, non-programmed dictionaries, and calculators are allowed.
3. The exam is four pages long, and it is divided into 2 Parts; Part I has one question, and Part II has 3 questions.
4. Total score is 100.
5. Answer all the questions in the answer book.

Dr. Jaruwan Klamklay
Asst. Prof. Dr. Angoon Sungkhapong

ทุจริตในการสอบ โทษขั้นต่ำคือ ปรับตกในรายวิชานั้น และพักการเรียน 1 ภาคการศึกษา

Part I (Instructor: Dr Jaruwan Klamklay)

1. In the job illustrated in Figure 1, products (W x L x H: 5x10x5 Inches) weigh 25 lb. arrive via a conveyor at a rate of 2-per minute. A worker picks up the product and places it in the cardboard box and then slides the packaged box to a conveyor behind table B. Assume that significant control of the object is required at the destination, and the worker twists to pick up the product; also assume that the coupling type is classified as "fair". The job is performed for a normal 8-hour shift, including regular rest allowance breaks.



a. Could this task cause the workers to have health problems? Analyze and show detailed explanation. (15 points)
b. According to (a), should you make any changes to this task to lower the health risks? Explain/sketch the changes you would make, and explain why you want to make those changes. Show your analysis to support your answer. (25 points)

Note: State your assumptions (if any)

Table 1: Horizontal Multiplier

H	HM	H	HM
in		cm	
<= 10	1.00	<=25	1.00
11	.91	28	.89
12	.83	30	.83
13	.77	32	.78
14	.71	34	.74
15	.67	36	.69
16	.63	38	.66
17	.59	40	.63
18	.56	42	.60
19	.53	44	.57
20	.50	46	.54
21	.48	48	.52
22	.46	50	.50
23	.44	52	.48
24	.42	54	.46
25	.40	56	.45
>25	.00	58	.43
		60	.42
		63	.40
		>63	.00

Table 2: Vertical Multiplier

V	VM	V	VM
in		cm	
0	.78	0	.78
5	.81	10	.81
10	.85	20	.84
15	.89	30	.87
20	.93	40	.90
25	.96	50	.93
30	1.00	60	.96
35	.96	70	.99
40	.93	80	.99
45	.89	90	.96
50	.85	100	.93
55	.81	110	.90
60	.78	120	.87
65	.74	130	.84
70	.70	140	.81
>70	.00	150	.78
		160	.75
		170	.72
		175	.70
		>175	.00

Table 3: Distance Multiplier

D	DM	D	DM
in		cm	
<=10	1.00	<=25	1.00
15	.94	40	.93
20	.91	55	.90
25	.89	70	.88
30	.88	85	.87
35	.87	100	.87
40	.87	115	.86
45	.86	130	.86
50	.86	145	.85
55	.85	160	.85
60	.85	175	.85
70	.85	>175	.00
>70	.00		

Table 4: Asymmetric Multiplier

A	AM
deg	
0	1.00
15	.95
30	.90
45	.86
60	.81
75	.76
90	.71
105	.66
120	.62
135	.57
>135	.00

Table 5: Coupling Multiplier

Coupling Type	Coupling Multiplier V< 30 inch (75 cm)	Coupling Multiplier V>= 30 inch (75 cm)
Good	1.00	1.00
Fair	0.95	1.00
Poor	0.90	0.90

**********GOOD LUCK**********

Table 6: Frequency Multiplier Table (FM)

Frequency Lifts/min (F):	Work Duration: <= 1 Hour V<30+	<= 1 Hour V>=30	>1 but <=2 Hours V<30	>1 but <=2 Hours V>=30	>2 but <=8 Hours V<30	>2 but <=8 Hours V>=30
<=0.2	1.00	1.00	.95	.95	.85	.85
0.5	.97	.97	.92	.92	.81	.81
1	.94	.94	.88	.88	.75	.75
2	.91	.91	.84	.84	.65	.65
3	.88	.88	.79	.79	.55	.55
4	.84	.84	.72	.72	.45	.45
5	.80	.80	.60	.60	.35	.35
6	.75	.75	.50	.50	.27	.27
7	.70	.70	.42	.42	.22	.22
8	.60	.60	.35	.35	.18	.18
9	.52	.52	.30	.30	.00	.15
10	.45	.45	.26	.26	.00	.13
11	.41	.41	.00	.23	.00	.00
12	.37	.37	.00	.21	.00	.00
13	.00	.34	.00	.00	.00	.00
14	.00	.31	.00	.00	.00	.00
15	.00	.28	.00	.00	.00	.00
>15	.00	.00	.00	.00	.00	.00

\+ Values of V are in inches
: For lifting less frequently than once per 5 minutes, set F = 0.2 lifts/minute.

Part II (Instructor: Asst Prof Dr Angoon Sungkhapong)

1. You are assigned to design displays and controls of an electrical- equipment which will be located in a noisy shop. The displays must show status of the controlled process. However, the operator needs to record some data from the continuous process for next analyses if necessary. What are your proposed displays and controls for this equipment? [Hint: clear explanation in concept and factors that affect your design are needed. Some more information may be assumed.] (20 points)

2. Explain the relationship between anthropometric data and design of effective controls. Three nice examples of controls are needed. (20 points)

3. How would you apply Ergonomics for productivity improvement? Explain clearly by using diagram. (20 points)

**********GOOD LUCK**********