Prince of Songkla University

The Faculty of Engineering

Final Examination Semester I **Academic Year: 2009**

Date: October 9, 2009. **Time:** 09:00 - 12:00

Subject: 225-456 Ergonomics **Room:** A400, A403

ทุจริตในการสอบ โทษขั้นต่ำคือ ปรับตกในรายวิชานั้น และพักการเรียน 1 ภาคการศึกษา

DIRECTIONS

1. Only short note on an A4 piece (both sides), dictionary and calculator are allowed.
2. 8 questions are given on 6 pages and must be done.
3. Total score is 100.
4. Your answers could be in English or Thai.
5. Please check all questions before start working.
6. Available examination time is 3 hours.

Good Luck

Asst.Prof. Angoon Sungkhapong, PhD.

1. What are the roles of glucose and oxygen on muscular work.
   (Hint: clear diagram should be shown.) (10 points)

2. There are six functional states which the human organism could claim in any moment. These states vary from *the extreme of sleep* to *a state of alarm*. Show the names of all six states and the recommended state for a man before start working. (5 points)

3. Compare five differences of *the capacity and limitation of human and machine* in working systems. (10 points)

4. The term "fatigue" has been used in so many different senses, but a reasonable distinction is the common division into *muscular fatigue* and *general fatigue*.
   a) Explain the causes and results of muscular fatigue. (5 points)
   b) How many types of general fatigue? Explain all of them clearly. (10 points)

5. Show five factors that affect the capacity of human's perceiving and transforming the data. How to improve this capacity for the workers? (10 points)

6. According to the data in Table 1, please suggest the appropriate distances of C, D and G which are shown in Figure 1. (20 points)

Table 1: Anthropometric data for Question # 6.

ANTHROPOMETRY OF FEMALE WORKERS (CM)
(AGE 17-55 YEAR, N = 250)

ANTHROPOMETRY	MEAN	STD	MIN	MAX	5TH	10TH	90TH	95TH
WEIGHT (Kg)	53.06	8.18	35.00	79.00	39.61	42.58	63.55	66.52
STATURE	151.20	4.82	140.00	170.40	143.29	145.02	157.38	159.70
ACROMION HEIGHT	124.68	4.88	114.37	155.43	116.65	118.42	130.93	132.70
BIDELTOID BREADTH	37.14	2.55	26.33	45.33	32.94	33.87	40.41	41.33
BICEPS CIRCUMFERENCE, FLEXED	26.37	3.51	20.00	37.33	20.59	21.87	30.87	32.15
BUTTOCK-POPLITEAL LENGTH	42.86	3.39	31.57	71.37	37.28	38.51	47.21	48.44
BUTTOCK-KNEE LENGTH	51.58	2.78	44.57	67.60	47.01	48.02	55.14	56.15
CALF CIRCUMFERENCE	33.56	3.01	20.70	45.20	28.62	29.71	37.42	38.51
CERVICALE HEIGHT	128.21	5.90	117.73	153.46	118.51	120.65	135.77	137.92
). CHEST CIRCUMFERENCE AT SCYE	84.64	10.00	60.86	114.10	68.18	71.82	97.46	101.09
1. ELBOW TO CENTER OF GRIP	31.19	2.16	25.23	45.07	27.64	28.43	33.96	34.74
2. ELBOW-TO-ELBOW BREADTH	39.47	4.12	30.30	53.00	32.69	34.19	44.75	46.25
3. ELBOW-FINGERTIP LENGTH	41.34	2.14	30.20	47.90	37.81	38.59	44.09	44.87
4. FACE BREADTH (BIZYGOMATIC)	11.20	0.68	9.16	17.83	10.08	10.33	12.07	12.31
5. FACE LENGTH (SELLION-MENTON)	17.42	1.17	14.30	24.06	15.49	15.92	18.93	19.35
6. FOOT BREADTH	8.73	0.77	6.83	11.16	7.46	7.74	9.72	10.00
7. FOOT LENGTH	22.23	2.05	15.53	32.26	18.95	19.70	24.94	25.68
8. FOREARM CIRCUMFERENCE, FLEXED	24.21	2.43	18.70	39.36	20.22	21.10	27.32	28.20
9. FUNCTIONAL REACH	67.93	5.38	55.50	81.53	59.07	61.03	74.82	76.78
0. FUNCTIONAL REACH, EXTENDED	75.69	5.01	60.50	87.36	67.46	69.28	82.11	83.93
1. HAND BREADTH	7.35	0.51	5.86	9.10	6.51	6.70	8.00	8.18
2. HAND LENGTH	16.96	3.29	14.57	67.56	11.55	12.74	21.18	22.37
3. HEAD CIRCUMFERENCE	52.91	2.26	35.33	65.40	49.19	50.01	55.80	56.62
4. HEAD LENGTH	17.03	0.68	15.40	18.83	16.04	16.16	17.90	18.02
5. HIP CIRCUMFERENCE	92.40	9.19	68.50	120.20	77.28	80.62	104.17	107.51
6. INTERSCYE, BACK	68.75	8.11	45.43	98.27	55.40	58.35	79.15	82.09
7. KNEELING HEIGHT	113.00	4.88	97.53	127.10	104.97	106.74	119.26	121.03
8. NECK CIRCUMFERENCE (BASED	31.00	2.77	24.60	42.60	26.44	27.55	34.55	35.56
9. OVERHEAD REACH BREADTH	31.73	2.26	22.73	43.36	28.01	28.83	34.63	35.45
0. OVERHEAD REACH HEIGHT	183.12	6.12	166.27	200.66	173.04	175.27	190.97	193.19
1. POPLITEAL HEIGHT	37.99	2.00	31.53	44.50	34.70	35.43	40.55	41.27
2. SHOULDER CIRCUMFERENCE	96.18	8.08	76.17	118.33	82.89	85.82	106.54	109.48
3. SHOULDER-ELBOW LENGTH	31.89	1.55	26.56	36.43	29.34	29.90	33.88	34.45
4. SHOULDER LENGTH	11.88	1.50	8.33	22.36	9.42	9.96	13.79	14.33
5. SITTING HEIGHT	78.77	3.16	71.60	97.17	73.57	74.72	82.81	83.96
6. SITTING THIGH BREADTH	31.59	2.57	24.16	41.70	27.36	28.30	34.89	35.83
7. UPPER THIGH CIRCUMFERENCE	50.71	6.38	35.00	78.30	40.22	42.53	58.88	61.20
8. VERTICAL TRUNK CIRCUMFERENCE	146.45	10.60	113.43	178.83	129.01	132.86	160.03	163.88
9. WAIST CIRCUMFERENCE (NATURAL)	73.22	10.37	46.50	97.77	56.15	59.92	86.52	90.28
0. WAIST BACK LENGTH	38.19	4.45	26.80	89.73	30.88	32.49	43.89	45.51
1. WAIST FRONT LENGTH	32.90	2.77	20.70	40.73	28.35	29.35	36.44	37.45
2. WAIST HEIGHT	92.70	4.89	65.13	110.20	84.65	86.43	98.96	100.74

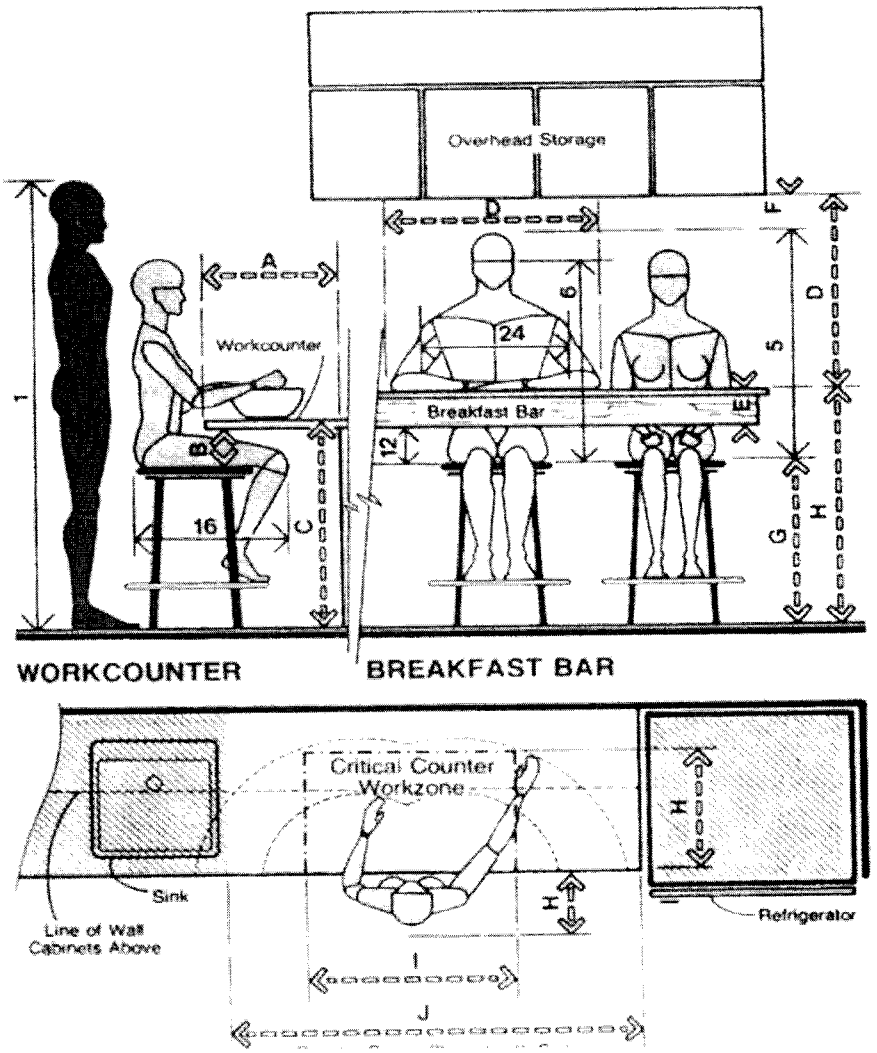

Figure 1: For Question # 6.

7. How do you realize that Ergonomics could improve productivity in production process? Explain and show a good case. (20 points)

8. *According to the statements from item 8-a to 8-j, some of them are true and some are false. Please read and analyze carefully then put the letter "T " for the true item and put "F" for the false one in your answer book.* (10 points)

(you will earn 1 point for your right answer, -1 point for your wrong answer. and 0 point for the blank answer.)

a) During muscle contraction, mechanical energy is developed at the expense of the reserves of chemical energy in the muscle.
b) The low-energy phosphate compounds are continuously converted back to high-energy state in the muscles with consuming energy gained from digested foodstuffs.
c) Static effort is characterized by an alternation of contraction and extension, or tension and relaxation.
d) A muscle performing dynamic work is flushed with blood and retains the energy-rich sugar and oxygen contained in it, while at the same time waste products are removed.
e) "Tilting the head strongly forwards or backwards" is an example of rhythmic effort.
f) "Putting the weight on one leg while the other works a pedal" is an example of postural effort.
g) The static work can be maintained for several hours per day without symptoms of fatigue if the force exerted does not exceed about 20% of the maximum force of the muscle involved.

h) One guideline for work layout is " Avoid keeping an arm outstretched either forwards or sideways."

i) Since natural postures and natural movements are necessary part of efficient work, it is essential that the workplace should be suited to the body size and mobility of the operator.

j) For standing work, both pulling and pushing forces are greatest in the horizontal plane and lowest in the vertical plane.

**********THE END**********