

**PRINCE OF SONGKLA UNIVERSITY
FACULTY OF ENGINEERING**

Final Term Examination : **Semester I**Academic Year : **2007**Date : **October 3, 2007.**Time : **13:30 - 16:30**Subject : **225-449 Industrial Plant Design**Room : **A401**
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**ทูลริตในการสอบ โทษันต้าปรับตทในรายวิชาันัน
และพัทการเรียน 1 ภาคการศึกษา**

Instructions :

1. There are 5 questions, 100 points.
2. Attempt all questions.
3. A sheet of paper note at size A4, a dictionary and a calculator are allowed.
4. Borrowing things from other students is prohibited.

Problem no.	Full Score	Score
1	15	
2	15	
3	20	
4	10	
5	40	
Total	100	

**Assoc. Prof. Dr. Sunchai Klinpikul
Instructor**

1. The Chicago Exponent plans to rent building space for a new print shop within the city limits. The locations for current distribution centers, expected deliveries are shown in the tables and figures below :

<u>Distribution Centers</u>	<u>X-Coordinate (km)</u>	<u>Y-Coordinate (km)</u>	<u>Weight (kgs per month)</u>
A	5	10	200
B	50	15	400
C	25	25	500
D	35	5	100
E	15	20	400
F	30	30	600

- (a) What is the best location for the new print shop? (10 points)
- (b) Sketch the geographic location of the print shop and distribution centers. (5 points)

2. Part X requires machining on a milling machine (Operation A and B are required). Find the number of machines required to produce 2,500 parts per week. Assume the company operates 5 days per week, 18 hours per day. The following information is known.

<u>Operation</u>	<u>Standard time</u>	<u>Scrap</u>
A	2 min.	2 %
B	4 min.	5 %

Note The milling machine requires tool changes and preventive maintenance after every lot of 400 parts. These changes requires 30 minutes.

(15 points)

3. The manufacturing engineers at Suny Manufacturing were working on a new remote controlled toy Monster Truck. They hire a production consultant to help them determine the best type of production process to meet the forecasted demand for this new product. The consultant recommended that they use an assembly line. He told the manufacturing engineers that the line must be able to produce 600 Monster Trucks per day to meet the demand forecast. The workers in the plant work 8 hours per day. The task information for the new Monster Truck is given below.

<u>Task</u>	<u>Task time (sec.)</u>	<u>Task that must precede</u>
A	28	-
B	13	-
C	35	B
D	11	A
E	20	C
F	6	D, E
G	23	F
H	25	F
I	37	G
J	11	G, H
K	<u>27</u>	<u>I, J</u>
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- a) Draw the precedence diagram. (2 points)
- b) Determine the required cycle time to meet the forecasted demand of 600 trucks per day and the minimum number of work stations given the answer in part B ? (3 points)
- c) Balance the assembly line using COMSOAL technique (select larger task first). What is the actual number of work stations and line efficiency. (15 points)

4. A sheet metal shop was in moving to new facility and wanted to create a layout for their new factory. The new building was 50 meters by 20 meters. The operations manager had looked into different methods for developing a layout and decided to try ALDEP algorithm with a sweep width of 1. The activity relationships among departments and area are given below :

	<u>Dept.</u>					<u>Area (m²)</u>
	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	
1. Cutting	A	E	I	U	U	200
2. Stamping	-	U	O	U	U	200
3. Welding		-	U	O	U	200
4. Etching			-	E	I	100
5. Sanding				-	X	200
6. Painting					-	100

Create a layout of this shop by using ALDEP algorithm.

(10 points)

5. Answer the following questions :

(1) Sketch an engineering flow diagram of underground water treatment system which removes iron, manganese, and hardness of the raw water.

(5 points)

(2) How to remove odour, colour and bacteria from raw water. Please explain briefly about the treatment, flow rate and contact time etc.

(5 points)

(3) Explain briefly about dust collectors used in industry. Sketch each type if you can.

(10 points)

(4) Explain briefly about thermal oil heater and steam boiler. How does each system work and what is the advantages and disadvantages ?

(10 points)

(5) Design and calculate a wastewater treatment system for a small factory using a facultative pond followed by a polishing pond where the flow rate of the wastewater is 200 cubic meters per day and influent BOD₅ is 700 ppm. Use design criteria as follows :

Detention time of facultative pond = 15 days

K₁ = 0.38 per day

Detention time of polishing pond = 12 days

What is the volume of each pond and the efficiency of the waste water treatment system ?

(5 points)

(6) List the main components of an air condition system and explain briefly about the function of each component.

(5 points)