PRINCE OF SONGKLA UNIVERSITY

FACULTY OF ENGINEERING

Final Examination : Semester 1 Academic Year : 2009

Date : October 8, 2009 Time : 9.00-12.00

Subject : 226-316 Material Handling System and Logistics Room : Robot

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Directions :

- Opened books examination.
- Show your solutions and method in the paper.
- There are 8 problems. You must do all of them.
- Can use any calculators.
- Total scores are 100.

Assoc. Prof. Wanida Rattanamanee

Name.....Code.....

ข้อ	คะแนนเต็ม	คะแนนที่ได้
1	10	
2	10	
3	10	
4	10	
5	20	
6	10	
7.	10	
8.	20	
รวม	100	

Name.....ID.....

1. **(10 points)**) Each aisle of a six-aisle Automated Storage/Retrieval System is to contain 50 storage compartments in the length direction and eight compartments in the vertical direction. All storage compartments will be the same size to accommodate standard size pallets of dimensions: x = 36 in., y = 48 in. and z = 30 in. Using the allowances a = 6 in., b = 8 in., and, c = 10 in., determine: (a) how many unit loads can be stored in the AS/RS and (b) the width, length, and height of the AS/RS. The rack structure will be built 18 in. above floor level.

Name.....ID.....

2. **(10 points)** A 10-aisle automated storage/retrieval system is located in an integrated factory-warehouse facility. The storage racks in each aisle are 18 m. high and 95 m. long. The S/R machine for each aisle travels at a horizontal speed of 1.5 m./sec. and a vertical speed of 0.5 m. / sec. Pick and deposit time = 20 sec. Assume that the number of single command cycles per hour is one-half the number of dual command cycles per hour and that the system operates at 80% utilization. Determine the throughput rate (loads moved per hour) of the AS/RS.

Name.....ID.....

3. (**10 points**) A single carousel storage system has an oval rail loop that is 30 ft. long and 3 ft. wide. Sixty carriers are equally space around the oval. Suspended from each carrier are five bins. Each bin has a volumetric capacity = 0.75 ft^3. Carousel speed = 100 ft./min. Average pick-and-deposit time for a retrieval = 20 sec. Determine: (a) volumetric capacity of the storage system and (b) hourly retrieval rate of the storage system.

Name.....ID.....

4. (**10 points**) Answer the following questions.

4.1 What is unit load?

4.2 From Figure 1, it is the application of unit load design. Explain how unit load design is applied for this figure and what is the benefit for this application?

4.3 From Figure 2, what is the concept of the shown Figure.

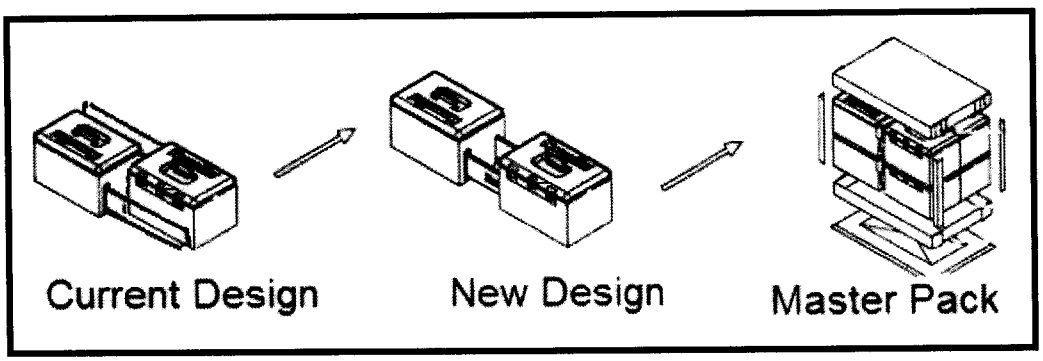

Figure 1

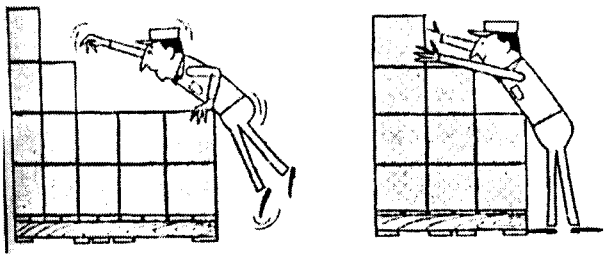

Figure 2

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5. (**20 points**) In a factory, there are 6 workstations, WS 1, WS 2, WS 3, WS 4, WS 5, and WS 6. There are 5 products; A, B, C, D and E produced in the factory by these 6 workstations. From-to-chart for the factory is shown in Table1. The factory manager would like to apply AGV system for the production. He designed AGV guided path as shown in Figure 3. Material handling capacity of the selected AGV type is 10 kilograms per trip. Its velocity is 15 meter per minute. Its efficiency is 0.9 and it has to be charged the energy after it works for 8 hours (t = 45 minutes). Pick up and drop off time is 0.6 and 0.8 min. respectively. There are 10 work hours per day. Determine the following questions

5.1 g_{12}, g_{13}, g_{23}, g_{35}, g_{36} and g_{45} (**6 points**)

5.2 How many AGVs should be applied in the factory. (use the 2nd case, equation 7.3, from chapter 7 of the book.) (**14 points**)

Table 1 From-to Chart between department

To / From	WS1	WS2	WS3	WS4	WS5	WS6
WS1	-	50	20	30	30	
WS2		-	45	20		20
WS3			-		10	
WS4	40		20	-		60
WS 5		50			-	40
WS6			20	20		-

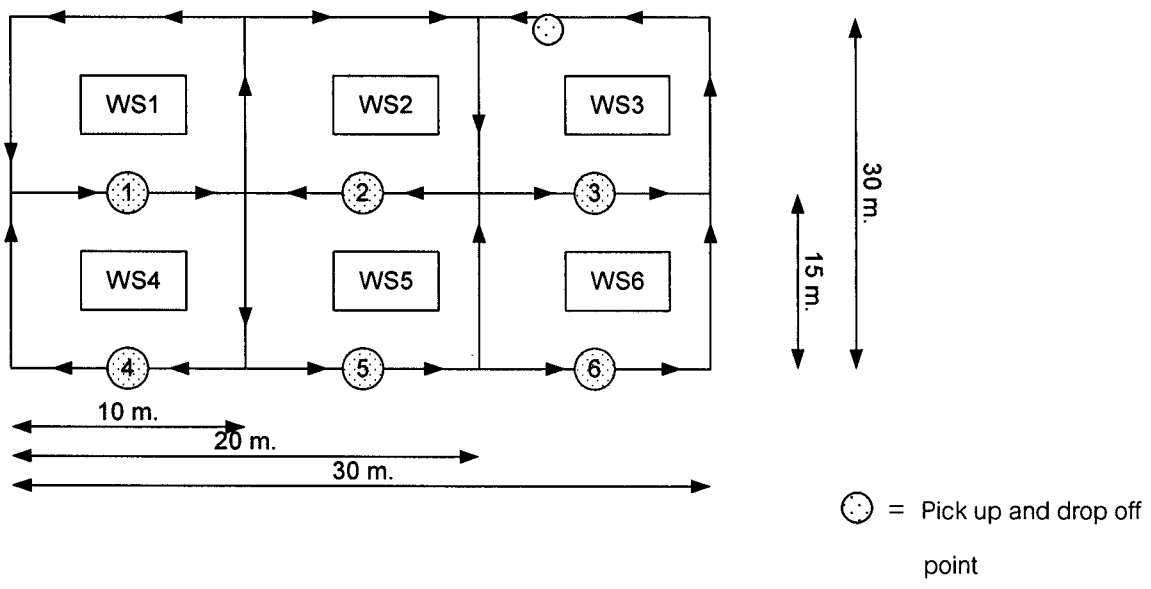

Figure 3 Guided path layout

Name.....ID.....

5.1 g_{12} =

g_{13} =

g_{23} =

g_{35} =

g_{36} =

g_{45} =

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5.2

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6. (**10 points**) Answer the following questions,

6.1 Explain relationship among "material flow", "group technology" and "Kanban".

6.2 From Figure 4, explain its main ideas.

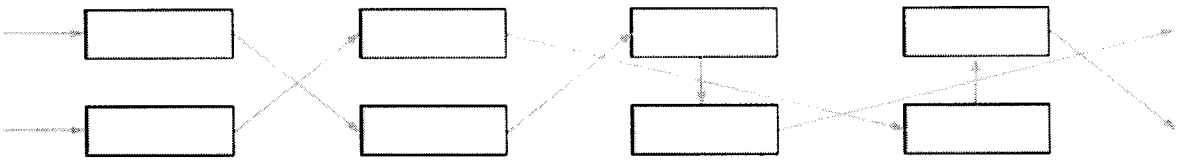

Figure 4

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7. (**10 points**) What are the meaning of "warehouse" and "AS/RS"? Explain and give some examples.

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Name.....ID.....

8. (**20 points**) From the class presentations, answer these following questions?

8.1 From the paper "AGV dispatching strategies at automated seaport container terminals", to generate a new terminal configuration, only four parameters are required. What are they?

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8.2 From warehouse and AS/RS Assignments,

8.2.1 What are the benefits of AS/RS ?

8.2.2 What is ABC system?

8.2.3 What are on-site and off-site warehouses?

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8.3 From robot assignment, what is the function of the robot as shown in Figure 5.

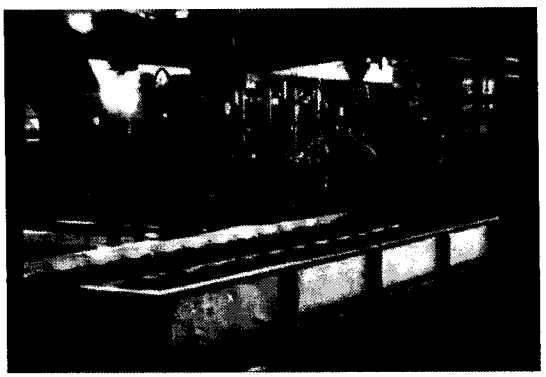

Figure 5

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8.4 From material flow assignments, what is relationship between material flow and lean system?

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8.5 What are dry and refrigerator cargoes?

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