

PRINCE OF SONGKLA UNIVERSITY
FACULTY OF ENGINEERING

Final Examination : Semester I

Academic Year : 2007

Date : October 9, 2007

Time : 9:00-12:00

Subject : 226-439 Logistics & Material handling system

Room : R200

Directions :

- Can take any books to the room.
- Show your solutions and method on the exam sheet.
- There are 8 problems, 100 points. You must do all of them.
- Can use any calculators.

Name.....Code

Question	Full Scores	Taken Scores
1	10	
2	10	
3	10	
4	20	
5	10	
6	10	
7	20	
8	10	
Total	100	

ทูลจริตในการสอบ โทษชั้นด่ำปรับตกในรายวิชานั้น และพักการเรียน 1 ภาคการศึกษา

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Lecturer

Wanida

1. Assume a truck is 90 inches wide, 105 inches high and 44.5 feet long. Assume your product package is 24 x 20 inches and is 12 inches high. If you use a pallet size of 40 × 48 inch., justify your number of packages per truckload. Determine by your own knowledge (it's not necessary to use any equation from the book), then answer 2 following important questions and show methods which are applied to determine.

1.1 How many packages can be arranged per pallet?

1.2 How many pallets can be arranged per truck?

(10 points)

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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? (10 points)

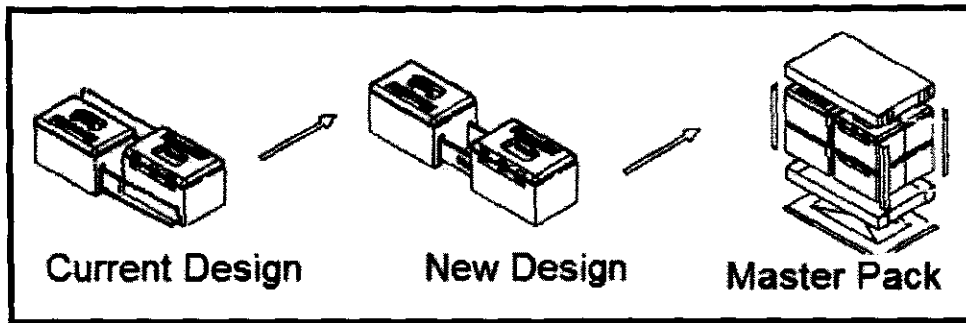


Figure 1

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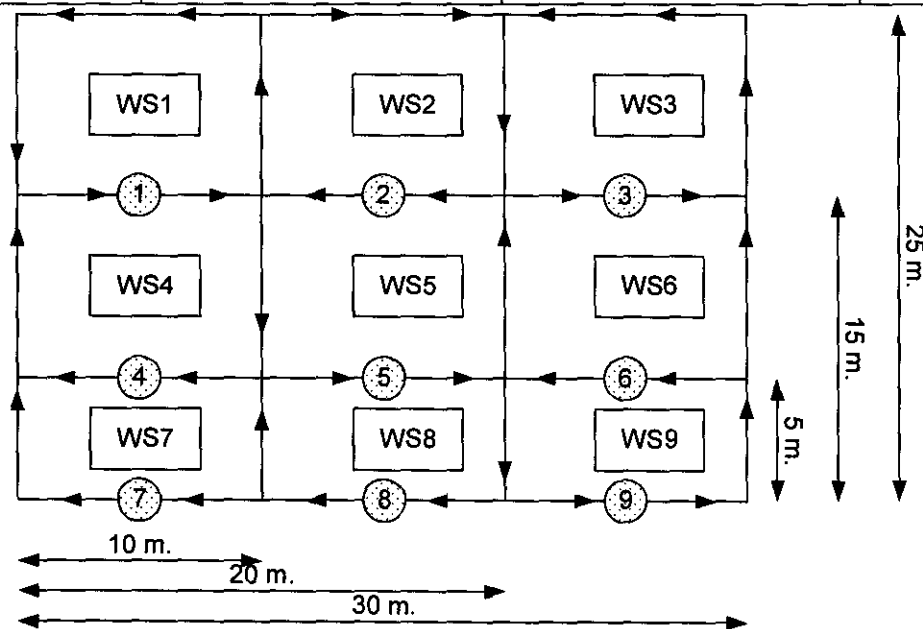
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3. In a factory, there are 9 workstations, WS 1, WS 2, WS 3, WS 4, WS 5, WS 6, WS 7, WS 8, and WS 9. There are 4 products; A, B, C and D, produced in the factory by these 9 workstations. Production type, production scheduling, production capacity, and product weight of each product are shown in Table 1. The factory manager would like to apply AGV system for the production. He designed AGV guided path as shown in Fig 2. Material handling capacity of the selected AGV type is 100 kilograms per trip. Its velocity is 2 meter per minute. Its efficiency is 0.8 and it has to be charged the energy after it works for 8 hours ($t = 30$ minutes). Pick up and drop off time is 0.5 and 0.6 respectively. If there are 10 work hours per day, how many AGV should be applied in the factory. (use the 2nd case, equation 7.3, from chapter 7 of the book.) (20 points)

Table 1 Detail of production

Product type	Production scheduling	Production capacity (parts/day)	Weight (kg.)/ part
A	1 → 3 → 4 → 6 → 7 → 9	2,000	0.5
B	2 → 3 → 4 → 5 → 6 → 8 → 9	5,000	0.5
C	1 → 2 → 3 → 4 → 5 → 6 → 7 → 8 → 9	1,000	0.8
D	1 → 4 → 5 → 6 → 7 → 8 → 9	3,000	0.5



○ = Pick up and drop off point

Figure 2 Guide path layout

OMU

4. From Figure 3, what is the type of the robot? What are appropriate works for the robot (shown in the figure3) ? Give other examples of this robot type. (10 points)



Figure 3.

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5. What is the meaning of AS/RS. Give an example of AS/RS application to the system that you're familiar. (10 points)

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6. Explain functions of these following AGV, (10 points)

6.1 AGV in the food industry

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6.2 AGV in the hospital

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6.3 AGV in the pharmacy industry

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6.4 AGV in the roll industry

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6.5 AGV in the AS/RS

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7. Consider an AS/RS with dedicated storage/retrieval machine per aisle, eight aisles in the whole system. Information regarding the system is as given below: (20 points)

- 1.1 unit load data: height of a unit load = 10 in., high clearance of the unit load in the slot = 2 in., width of a unit load = 10 in., wide total clearance of the unit load in the slot = 2 in., length of a unit load = 10 in., high total clearance of the unit load in the slot = 2 in.
- 1.2 two feet wide aisles separate racks from the side walls and one end of wall of the structure
- 1.3 length of a storage aisle = 150 unit loads
- 1.4 height of a storage aisle = 50 unit loads
- 1.5 height between top level of rack and building ceiling = 10 in.
- 1.6 aisle length of 10 ft. is required in front of the system to support the P/D stations and other material handling devices used for delivering and removing loads from the AS/RS. The P/D station is located at the end of the S/R aisle.
- 1.7 Pick up or drop off time per unit load = 0.25 min

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- Q-1 What is the minimum space requirement (Volume) of the AS/RS system?(10 points)
- Q-2 Can the S/R machine handle the handling workload over the eight hours? (10 points)
- Q-3 If the answer of Q-2 is yes, what is the utilization of the S/R machine? If not, how many storages and retrievals can be performed 8 hours per aisle? (10 points)

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1.8 Average system horizontal and vertical travel speed are 300 ft./min and 100 ft./min respectively.

1.9 70% of the storages and retrievals are done under single command cycle. 30% of the storages and retrievals are performed under dual command cycles.

1.10 It is intended that 500 storages and 500 retrievals are to be performed 8 hours per aisle. Each aisle has a dedicated S/R machine.

Determine:

Q-1 What is the minimum space requirement (Volume) of the AS/RS system?(10 points)

Q-2 Can the S/R machine handle the handling workload over the eight hours? (10 points)

Q-3 If the answer of Q-2 is yes, what is the utilization of the S/R machine? If not, how many storages and retrievals can be performed 8 hours per aisle? (10 points)

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