

PRINCE OF SONGKLA UNIVERSITY  
FACULTY OF ENGINEERING

Final Examination : Semester 2

Academic Year : 2005

Date : March 1, 2006

Time : 9.00-12.00

Subject : 226-532 Manufacturing Automation

Room : R300

Direction

- There are 3 questions. The total score is 100.
- Write your own answer on the exam papers.
- All materials, books, calculators are allowed.

Assist. Prof. Wanida Rattanamanee

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

ข้อ	คะแนนเต็ม	คะแนนที่ได้
1	30	
2	30	
3	40	
รวม	100	



2. (30 points) 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:
- 2.1 unit load data: height of a unit load = 50 in., high clearance of the unit load in the slot = 10 in., width of a unit load = 50 in., wide total clearance of the unit load in the slot = 8 in., length of a unit load = 40 in., high total clearance of the unit load in the slot = 6 in.
  - 2.2 two feet wide aisles separate racks from the side walls and one end of wall of the structure
  - 2.3 length of a storage aisle = 80 unit loads
  - 2.4 height of a storage aisle = 12 unit loads
  - 2.5 height between top level of rack and building ceiling = 20 in.
  - 2.6 aisle length of 20 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.
  - 2.7 Pick up or drop off time per unit load = 0.20 min
  - 2.8 Average system horizontal and vertical travel speed are 300 ft./min and 50 ft./min respectively.
  - 2.9 60% of the storages and retrievals are done under single command cycle. 40% of the storages and retrievals are performed under dual command cycles.
  - 2.10 It is intended that 200 storages and 200 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)

- vehicle scheduling
- Idle-vehicle positioning
- battery management

3. (40 points) Explain the following topics by short answers for each.

3.1 (10 points) What is a climbing cleaning robot?

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3.2 (10 points) A presented paper was a review on design and control of automated guided vehicle systems. Explain about the following topics.

- guide-path design

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- determining vehicle requirements

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- vehicle scheduling

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- Idle-vehicle positioning

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- battery management

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- vehicle routing and deadlock

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3.3 (10 points) What is the objective of the "Optimal design of rack structure with modular cell in AS/RS" paper?

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3.4 (10 points) Explain about these manufacturing systems and how can automation systems be applied for the manufacturing systems?

- Group technology

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- Cell manufacturing

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- Kaizen

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- Just in time

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