

**PRINCE OF SONGKLA UNIVERSITY**  
**FACULTY OF ENGINEERING**

Final Examination: Semester 1

Academic Year: 2005

Date: October 3, 2005

Time: 9:00-12:00

Subject: 226-501 Manufacturing Systems & Tech. Room: R300

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**Instructions**

- Answer all 5 questions in the **answer** book.
- All materials, books, papers, calculators and dictionaries are allowed. (Open-book exams)
- Total score is 100.

<b>Questions</b>	<b>Full Score</b>	<b>Assigned Score</b>
Q1	20	
Q2	20	
Q3	20	
Q4	20	
Q5	20	
<b>Total</b>	<b>100</b>	

Asst. Prof. Somchai Chuchom

ทูลริตในการสอบ โทษขันต่ำคือ ปรับตกในรายวิชาที่ทูลริต และพักการเรียน 1 ภาคการศึกษา



**Question 1** (20 marks)

Select one department or working area of the plant visited during the course,

- 1.1 Describe the technologies concerned and main elements of the manufacturing system.
- 1.2 Discuss its degree of automation and giving details of the integration of the elements applied.

**Question 2** (20 marks)

- 2.1 Explain the principle of Numerical Control, and briefly explain the functions that are expected to be served by Numerical Control in machine tools.
- 2.2 What are the design criteria to be used in designing CNC machine tools?
- 2.3 Briefly describe about the type of electric drives used in CNC machine tools.
- 2.4 Give a comparison of the encoder and linear scale as a feedback device for displacement in CNC machine tools.

**Question 3** (20 marks)

- 3.1 What do you understand by the term 'flexibility' in FMS? What are the various types of flexibilities that are relevant?
- 3.2 Mr. A was asked to design the FMS system to machine 2360 different parts of valves. The major components are the valve bodies and bonnets in the size ranges of 1.5 to 24 inches. The FMS is to replace the existing special purpose machine tools used for their manufacture. In view of the complexity of the body shape, fixtures are required for holding the bodies. Based on the past annual figures of production, the work load estimated as shown in Table 3-1.

Table 3-1 Operation Plan and Routing for Parts

<i>Part type</i>	<i>Bonnet</i>	<i>Body A</i>	<i>Body B</i>
Operations	Load Machining center Wash Unload	Load Machining center Outface Wash Unload	Load Machining center Wash Fit Outface Wash Unload
Total value	10%	65%	25%

Based on the annualized requirements, the equipment for FMS was finalized as follows:

- 5 FM100 Machining centers (KTM)
- 2 CNC Out facing machines (KTM)
- Component washing
- Seat ring fitting
- Automated guided vehicles (AGV)
- Fixture storage and setting (manual)
- Tool setting (manual)
- Raw material supply (AS/RS)
- Load and Unload station (manual)
- Static buffers
- Battery charging for AGV
- AGV waiting area
- Computer control room

The actual machining time required for individual component is between 8 and 9 minutes with the total load and unload frequency of 2.5 minutes. In view of such small cycle time and the complexity of the operations involved, a major investigation is required. The major areas that were investigated are:

- Tool management
- Fixture management
- Raw material/ finished parts management
- Ring fitting facility
- Transport management

Mr. A has proposed the machine block layout, the completed cell, and the FMS system shown in Figure 3-1, 3-2 and 3-3 respectively. Discuss on the suitability of the system proposed by Mr. A, and give detail suggestion on the investigation of the major areas mentioned above.

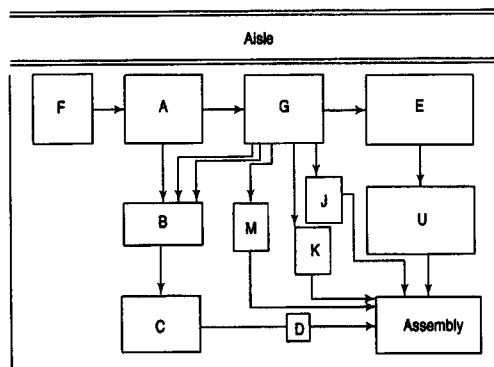


Figure 3-1 Machine Block Layout (Part flow relationship)

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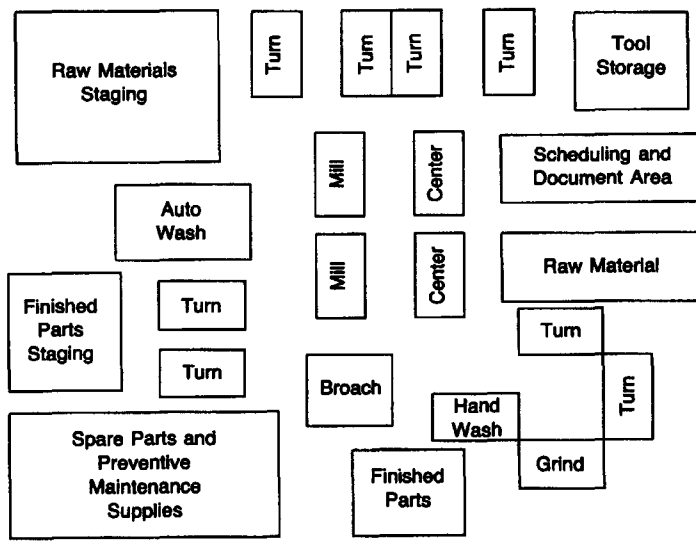


Figure 3-2 Completed Cell with all the space required

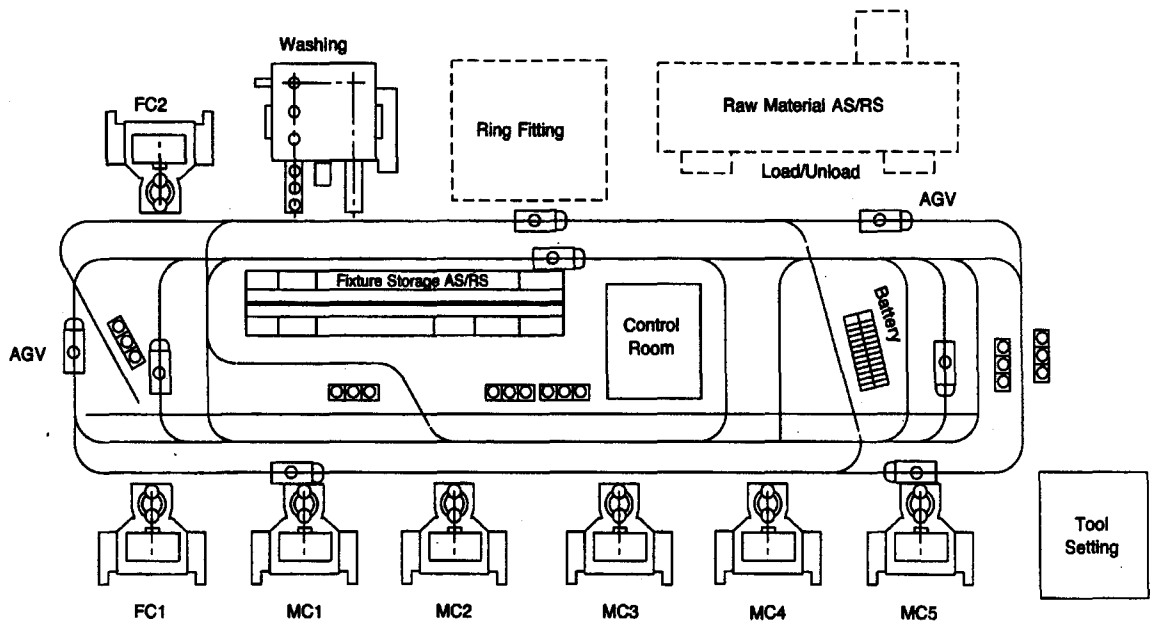


Figure 3-3 FMS system for machining valve components

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**Question 4 (20 marks)**

Explain in detail about JIT on the following topics:

4.1 JIT concepts and principles

4.2 JIT techniques (tools to achieve the objectives)

4.3 In the future JIT together with CIM will become the modern type of manufacturing system called JIT\**CIM* system. Sketch the diagram or the picture to show all elements and their links and explain how to achieve the objectives.

**Question 5 (20 marks)**

In order to integrate each component of the manufacturing system to co-operate and achieve the target, the following support systems will be provided. Choose one, and explain in detail what you know about it.

- Basic material handling system
  - Advanced material handling system
  - Data Exchange Standards (Graphics)
  - Communication Standards
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