

PRINCE OF SONGKLA UNIVERSITY
FACULTY OF ENGINEERING

Midterm Examination : Semester 2

Academic Year : 2007

Date : December 28, 2007

Time : 13:30-16:30

Subject : 226-431 Manufacturing Automation System,
226-433 Manufacturing Automation

Room : R300

Direction

- There are 10 questions. The total score is 100.
- Write your own answer on the exam paper.
- All materials, books, calculators are allowed.

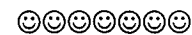
Assoc. Prof. Wanida Rattanamanee

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

Question	Full Points	Assigned Points
1	6	
2	7	
3	7	
4	10	
5	20	
6	6	
7	4	
8	15	
9	10	
10	15	
รวม	100	

ทฤษฎีในการสอบ โทษขั้นต่ำ คือ พักการเรียน 1 ภาคการศึกษา และปรับตกในรายวิชาที่ทฤษฎี

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1. Explain the functions of the manufacturing support system? (6 points)

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2. In the smoked rubber manufacturing, what are the system facilities and support systems? (7 points)

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3. What are the differences among 3 basic types of automated manufacturing systems? (7 points)

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4. Give and explain 5 reasons for automating. (10 points)

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5. A certain part is routed through six machines in a batch production plant. The setup and operation times for each machine are given in the table below. The batch size is 100 and the average nonoperation time per machine is 12 hr. Determine
- a.) manufacturing lead time
 - b.) production rate for operation 1,3,5.

Machine	Setup time (hr.)	Operation time (min.)
1	4	5.0
2	2	3.5
3	8	10.0
4	3	1.9
5	3	4.1
6	4	2.5

Suppose the part is made in very large quantities on a production line in which an automated work handling system is used to transfer parts between machines. Transfer time between stations = 15 s. The total time required to set up the entire line is 150 hr. Assume that the operation times at the individual machines remain the same. Determine

- c.) manufacturing lead time for a part coming off the line.
- d.) Production rate for operation 1,3,5
- e.) theoretical production rate for the entire production line.

(20 points)

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6. How many basic elements of an automated system? Explain their details. (6 points)

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7. Describe accuracy and repeatability of the CNC machine system. (4 points)

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8. A stepping motor is used to drive the x- axis of an NC milling machine table. The motor is coupled directly to the table leadscrew, which has 5 threads/in. It is connected to the leadscrew using a 6 : 1 gear ratio (6 turns of the motor converts to 1 turn of the leadscrew). The motor has 200 steps per revolution. To execute a certain programmed instruction, the table must be moved from point (2, 1) to point (4, 5) at a speed of 10 in./min. Determine (a) the number of pulses to control the x axis, (b) the rotational speed of the motor, and (c) the pulse rate (15 points)

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9. The part drawing shown in Figure 1 is to be machined from a 6 in. × 7 in. × 3.5 in. workpiece. The workpiece material is low-carbon steel. We will use a hypothetical 3-axis CNC machining center for the process. The process plan for the part is as follows:

- Set the lower-left bottom corner of the part as the machine zero point.
- Clamp the workpiece in a vise.
- Mill the slot with a 1-in. four-flute flat, end mill made of carbide. From the Machine ability Data Handbook, the recommended feed is 0.005 in./tooth/rev and the recommended cutting speed is 650 fpm.
- Drill 4 holes with a 1-in. diameter twist drill. Use 0.18-ipr feed and 100-fpm speed.

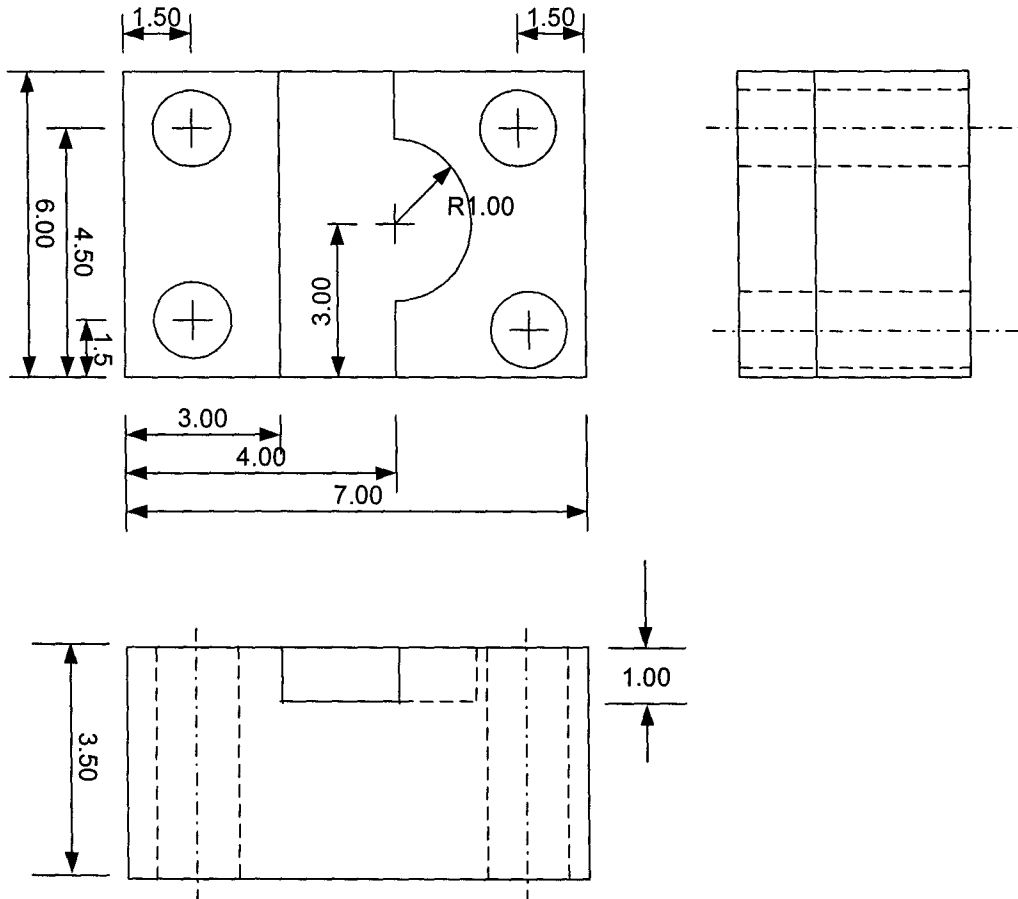


Figure 1 Workpiece

Figure 2 Shows the setup, fixturing and cutter path. The G-code program for the part can be written as shown in Table 1. Fill the answers for the blanks of Table 1 and show your calculation. (10 points)

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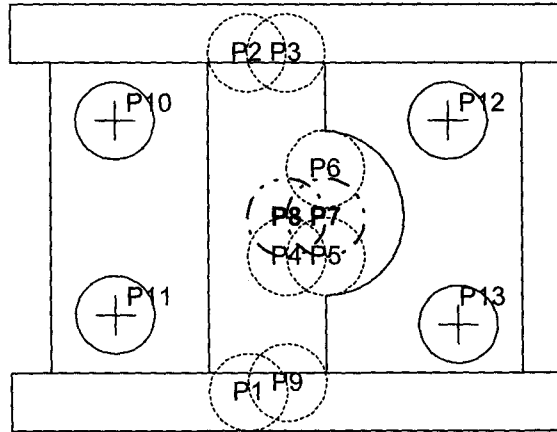


Figure 2 Setup and cutter path for the workpiece

Table 1 Part program for the workpiece in Figure 1

N0010	G ___ G ___ T08 M ___
N0020	G00 X ___ Y ___ Z4.00 S ___
N0030	G01 Z ___ F ___ M ___
N0040	G01 Y5.2
N0050	G01 X ___
N0060	G01 Y ___
N0070	G01 ___ 3.5
N0080	G ___ Y ___ I3.50 J2.50
N0090	G01 ___ 2.5
N0100	G01 X ___
N0110	G01 ___ -0.2
N0120	G ___ Z4.00 T02 M ___
N0130	F ___ S ___ M ___
N0140	G83 X1 Y4 Z ___ R1.00 Q1.00
N0150	Y ___
N0160	_____
N0170	Y1
N0180	G ___
N0190	G00 X-1.0 Y-1.0 M ___

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10. From Figure. 3, what are the activities of material handling system? List all of them and explain in detail.

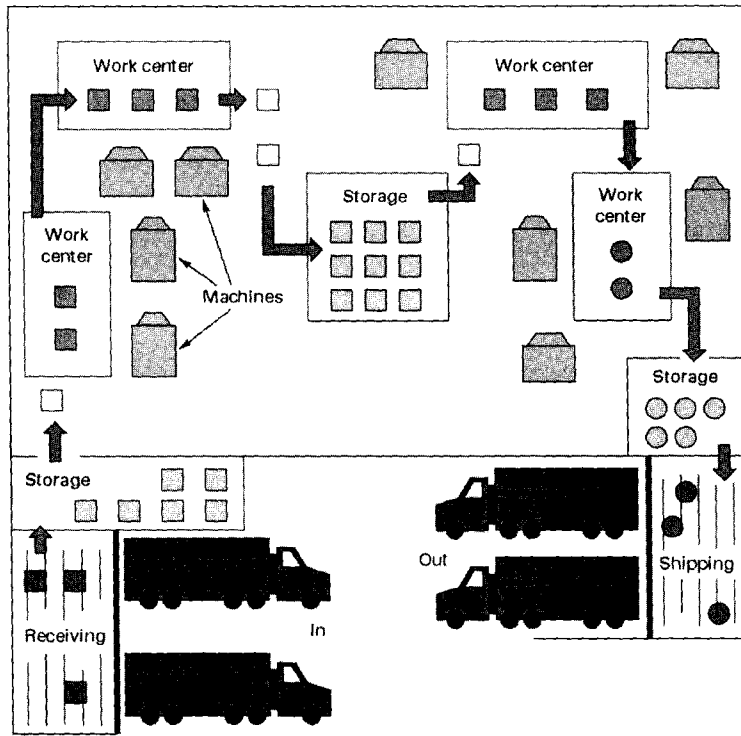


Figure. 3

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