## **GUJARAT TECHNOLOGICAL UNIVERSITY** M. E. - SEMESTER – II • EXAMINATION – WINTER • 2014

Subject code: 1725002

Date: 03-12-2014

Subject Name: Computer-Integrated Manufacturing

Time: 02:30 pm - 05:00 pm

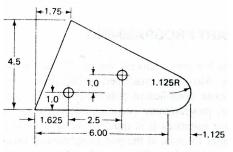
Total Marks: 70

Instructions:

- 1. Attempt all questions.
- 2. Make suitable assumptions wherever necessary.
- 3. Figures to the right indicate full marks.
- Q.1 (a) Explain the CIM wheel and the meaning of CIM as suggested by CASA/SME. 07 Is CIM a concept or a technology?
  - (b) Categorize the different types of manufacturing explaining each type clearly. 07
- Q.2 (a) Explain closed-loop control system used in an NC machine using a block 07 diagram. State its benefits and drawbacks.
  - (b) State the general characteristics of an industrial situation which tend to make 07 the installation of a robot economical. What are the application areas for industrial robots in production premises?

## OR

(b) The following figure shows final geometry to be obtained from a workpiece 07 which has previously been rough cut to this outline. The tool is a <sup>1</sup>/<sub>2</sub>-in.-diameter end-milling cutter, cutting speed = 573 rpm, feed = 2.29 in./min. Prepare a manual part program. State where you find difficulty in this task and give an idea to overcome it.



Dimensions are in inch

- Q.3 (a) Explain the following NC motion control systems with figure: PTP, Straight 07 cut, Contouring.
  - (b) Show the general configuration of a DNC system and elaborate its four basic 07 components.

OR

Q.3 (a) Discuss the steps, in sequence, which must be accomplished to utilize 05 numerical control in manufacturing.

A workpiece of a low-carbon steel plate has previously been cut out in the 09 **(b)** rough shape of the final part outline. The complete APT program to machine the periphery of the part is shown below. Write down as many technical details (tooling as you can, regarding machining data and cutting parameters/conditions) the programmer has chosen. Also draw the accurate final geometry of the part that would be obtained after NC machining using this program. Assume absolute positioning has been used and dimensions are in inch.

PARTNO       EXAMPLE PART MACHIN/MILL, 1 CLPRNT INTOL/001 OUTTOL/.001 CUTTER/.500         P0       = POINT/0, -1.0, 0 POINT/0, -1.0, 0 P1         P1       = POINT/0, 0, 0 P0INT/6.0, 0, 0 P3         P3       = POINT/0, 0, 0 P4         P4       = DOINT/0, -1.0, 0 P1         1       = LINE/P2, P3 CI         C1       = CIRCLE/CENTER, P1, RADIUS, 1.129 CIRCLE/CENTER, P1, RADIUS, 1.129 CIRCLE/CENTER, P1, RADIUS, 1.129 CIRCLE/CENTER, P1, RADIUS, 1.129 COLNT/0N FEDRAT/2.29 COOLNT/ON FROM/P0 GO/T0, L1, T0, PL1, T0, L3 GORGT/L1, TANTO, C1 GOFWD/C1, PAST, L2 GOFWD/C1, PAST, L3 GOLFT/L3, PAST, L1 RAPID	Column	1	is constron, copical loc XC
MACHIN/MILL, 1 CLPRNT INTOL/.001 OUTTOL/.001 OUTTOL/.001 CUTTER/.500 P0 = POINT/0, -1.0, 0 P1 = POINT/6.0, 1.125, 0 P2 = POINT/6.0, 0, 0 P3 = POINT/6.0, 0, 0 P4 = POINT/1.75, 4.5, 0 L1 = LINE/P2, P3 C1 = CIRCLE/CENTER, P1, RADIUS, 1.129 L2 = LINE/P2, P4 PL1 = PLANE/P2, P4 PL1 = PLANE/P2, P3 FEDRAT/2.29 COOLNT/ON FROM/P0 GO/T0, L1, T0, PL1, T0, L3 GOFWD/C1, PAST, L2 GOFWD/L2, PAST, L3 GOLFT/L3, PAST, L1 RAPID	1 6		and the subject of th
CLPRNT         INTOL/.001         OUTTOL/.001         CUTTER/.500         P0         P1         P0INT/0, -1.0, 0         P2         P0INT/0, 0, 0         P3         P0INT/6.0, 1.125, 0         P4         P0INT/6.0, 0, 0         P4         P0INT/0, -1.0, 0         P3         P0INT/6.0, 1.125, 0         P4         P0INT/6.0, 0, 0         P3         P0INT/6.0, 0, 0         P4         P0INT/6.0, 0, 0         P4         P0INT/0, 5, 4.5, 0         L1         L1         L1         L1         L1         L1         L1         P1	PARTNO	E	EXAMPLE PART
INTOL/.001         OUTTOL/.001         CUTTER/.500         POINT/0, -1.0, 0         P1         P0INT/0, 0, 0         P3         POINT/6.0, 1.125, 0         P4         POINT/6.0, 0, 0         P4         C1         PL1         PL1         PL1         PL3         PL4         PL4         PL1         PL3         PL3         PL4         PL4         PL1         PL3         PL3         PLANE/P2, P3, P4         SPINDL/573         FEDRAT/2.29         COOLNT/ON         FROM/P0         GOFWD/C1, PAST, L2         GOFWD/C1, PAST, L3         GOLFT/L3, PAST, L1         RAPID		1	MACHIN/MILL, 1
OUTTOL/.001         CUTTER/.500         POINT/0, -1.0, 0         P1       =         POINT/0, 0, 1.125, 0         P2       =         POINT/0, 0, 0         P3       =         POINT/0, 0, 0         P4       =         POINT/1.75, 4.5, 0         L1       =         L1NE/P2, P3         C1       =         C1       =         L1NE/P2, P3         PL1       =         PLANE/P2, P3, P4         SPINDL/573         FEDRAT/2.29         COOLNT/ON         FROM/P0         GO/TO, L1, TO, PL1, TO, L3         GOFWD/C1, PAST, L2         GOFWD/C1, PAST, L3         GOLFT/L3, PAST, L1         RAPID			
PO       =       CUTTER/.500         POINT/0, -1.0, 0       POINT/6.0, 1.125, 0         P2       =       POINT/6.0, 0         P3       =       POINT/6.0, 0         P4       =       POINT/7.75, 4.5, 0         L1       =       LINE/P2, P3         C1       =       CIRCLE/CENTER, P1, RADIUS, 1.124         L2       =       LINE/P2, P3         L3       =       LINE/P2, P4         PL1       =       PLANE/P2, P3, P4         SPINDL/573       FEDRAT/2.29         COOLNT/ON       FROM/P0         GO/TO, L1, TO, PL1, TO, L3         GOFWD/C1, PAST, L2         GOFWD/C1, PAST, L3         GOLFT/L3, PAST, L1         RAPID			
P0 = P0INT/0, -1.0, 0 P1 = P0INT/0, -1.0, 0 P2 = P0INT/0, 0, 0 P3 = P0INT/6.0, 1.125, 0 P4 = P0INT/1.75, 4.5, 0 L1 = LINE/P2, P3 C1 = CIRCLE/CENTER, P1, RADIUS, 1.125 L2 = LINE/P4, LEFT' TANTO, C1 L3 = LINE/P2, P4 PL1 = PLANE/P2, P3, P4 SPINDL/573 FEDRAT/2.29 CO0LNT/ON FROM/P0 G0/T0, L1, T0, PL1, T0, L3 G0FWD/C1, PAST, L2 G0FWD/L2, PAST, L3 G0LFT/L3, PAST, L1 RAPID			
P1 = P0INT/6.0, 1.125, 0 P2 = P0INT/6.0, 0, 0 P3 = P0INT/6.0, 0, 0 P4 = P0INT/1.75, 4.5, 0 L1 = LINE/P2, P3 C1 = CIRCLE/CENTER, P1, RADIUS, 1.129 L2 = LINE/P4, LEFT' TANTO, C1 L3 = LINE/P2, P4 PL1 = PLANE/P2, P3, P4 SPINDL/573 FEDRAT/2.29 COOLNT/ON FROM/P0 G0/T0, L1, T0, PL1, T0, L3 G0FWD/C1, PAST, L2 G0FWD/L2, PAST, L3 G0LFT/L3, PAST, L1 RAPID			CUTTER/.500
P2       =       POINT/0, 0, 0         P3       =       POINT/6.0, 0, 0         P4       =       POINT/1.75, 4.5, 0         L1       =       LINE/P2, P3         C1       =       CIRCLE/CENTER, P1, RADIUS, 1.124         L2       =       LINE/P4, LEFT' TANTO, C1         L3       =       LINE/P2, P4         PL1       =       PLANE/P2, P3, P4         SPINDL/573       FEDRAT/2.29         COOLNT/ON       FROM/P0         GO/TO, L1, TO, PL1, TO, L3       GORGT/L1, TANTO, C1         GOFWD/C1, PAST, L2       GOFWD/L2, PAST, L3         GOLFT/L3, PAST, L1       RAPID	PO		
P3 = POINT/6.0, 0, 0 P4 = POINT/1.75, 4.5, 0 L1 = LINE/P2, P3 C1 = CIRCLE/CENTER, P1, RADIUS, 1.129 L2 = LINE/P4, LEFT' TANTO, C1 L3 = LINE/P2, P4 PL1 = PLANE/P2, P3, P4 SPINDL/573 FEDRAT/2.29 COOLNT/ON FROM/P0 GO/TO, L1, TO, PL1, TO, L3 GOFWD/C1, PAST, L2 GOFWD/L2, PAST, L3 GOLFT/L3, PAST, L1 RAPID	P1		
P4 = POINT/1.75, 4.5, 0 L1 = LINE/P2, P3 C1 = CIRCLE/CENTER, P1, RADIUS, 1.129 L2 = LINE/P4, LEFT' TANTO, C1 L3 = LINE/P2, P4 PL1 = PLANE/P2, P3, P4 SPINDL/573 FEDRAT/2.29 COOLNT/ON FROM/P0 GO/TO, L1, TO, PL1, TO, L3 GOFWD/C1, PAST, L2 GOFWD/L2, PAST, L3 GOLFT/L3, PAST, L1 RAPID	P2		
L1 = LINE/P2, P3 C1 = CIRCLE/CENTER, P1, RADIUS, 1.129 L2 = LINE/P4, LEFT' TANTO, C1 L3 = PLANE/P2, P4 PL1 = PLANE/P2, P3, P4 SPINDL/573 FEDRAT/2.29 COOLNT/ON FROM/P0 GO/TO, L1, TO, PL1, TO, L3 GOFWD/C1, PAST, L2 GOFWD/L2, PAST, L3 GOLFT/L3, PAST, L1 RAPID	P3	= 1	POINT/6.0, 0, 0
C1 = CIRCLE/CENTER, P1, RADIUS, 1.12 L2 = LINE/P4, LEFT' TANTO, C1 L3 = LINE/P2, P4 PL1 = PLANE/P2, P3, P4 SPINDL/573 FEDRAT/2.29 COOLNT/ON FROM/P0 GO/TO, L1, TO, PL1, TO, L3 GOFWD/C1, PAST, L2 GOFWD/L2, PAST, L3 GOLFT/L3, PAST, L1 RAPID	P4		
L2 = LINE/P4, LEFT' TANTO, C1 L3 = LINE/P2, P4 PL1 = PLANE/P2, P3, P4 SPINDL/573 FEDRAT/2.29 COOLNT/ON FROM/P0 GO/TO, L1, TO, PL1, TO, L3 GOFWD/C1, PAST, L2 GOFWD/L2, PAST, L3 GOLFT/L3, PAST, L1 RAPID	L1	=	LINE/P2, P3
L3 = LINE/P2, P4 PL1 = PLANE/P2, P3, P4 SPINDL/573 FEDRAT/2.29 COOLNT/ON FROM/P0 GO/TO, L1, TO, PL1, TO, L3 GOFWD/C1, PAST, L2 GOFWD/L2, PAST, L3 GOLFT/L3, PAST, L1 RAPID	C1	= (	CIRCLE/CENTER, P1, RADIUS, 1.125
PL1 = PLANE/P2, P3, P4 SPINDL/573 FEDRAT/2.29 COOLNT/ON FROM/P0 GO/TO, L1, TO, PL1, TO, L3 GORGT/L1, TANTO, C1 GOFWD/C1, PAST, L2 GOFWD/L2, PAST, L3 GOLFT/L3, PAST, L1 RAPID	L2	=	LINE/P4, LEFT' TANTO, CI
SPINDL/573 FEDRAT/2.29 COOLNT/ON FROM/PO GO/TO, L1, TO, PL1, TO, L3 GORGT/L1, TANTO, C1 GOFWD/C1, PAST, L2 GOFWD/L2, PAST, L3 GOLFT/L3, PAST, L1 RAPID	L3		
FEDRAT/2.29 COOLNT/ON FROM/PO GO/TO, L1, TO, PL1, TO, L3 GORGT/L1, TANTO, C1 GOFWD/C1, PAST, L2 GOFWD/L2, PAST, L3 GOLFT/L3, PAST, L1 RAPID	PL1		
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GO/TO, L1, TO, PL1, TO, L3 GORGT/L1, TANTO, C1 GOFWD/C1, PAST, L2 GOFWD/L2, PAST, L3 GOLFT/L3, PAST, L1 RAPID			
GORGT/L1, TANTO, C1 GOFWD/C1, PAST, L2 GOFWD/L2, PAST, L3 GOLFT/L3, PAST, L1 RAPID			
GOFWD/C1, PAST, L2 GOFWD/L2, PAST, L3 GOLFT/L3, PAST, L1 RAPID			
GOFWD/L2, PAST, L3 GOLFT/L3, PAST, L1 RAPID			
GOLFT/L3, PAST, L1 RAPID			
RAPID		101.01	GUEWD/L2, PAST, L3
			GOTO/PO
COOLNT/OFF			
FINI			

- Q.4 (a) Discuss the functions performed by the FMS computer control system category 07 wise.
  - (b) A flexible machining system consists of two machining workstations and a load/unload station. Station 1 is the load/unload station. Station 2 performs milling operations and consists of two servers (two identical CNC milling machines). Station 3 has one server that performs drilling (one CNC drill press). The stations are connected by a part handling system that has four work carriers. The mean transport time is 3.0 min. The FMS produces two parts, A and B. The part mix fractions and process routings for the two parts are presented in the table below. The operation frequency = 1.0 for all operations. Determine: (a) maximum production rate of the FMS, (b) corresponding production rates of each product, (c) utilization of each station, and (d) number of busy servers at each station.

Part j	Part Mix p <sub>i</sub>	Operation k	Description	Station i	Process Time t <sub>ijk</sub> (min)
А	0.4	1	Load	1	4
		2	Mill	2	30
		3	Drill	3	10
		4	Unload	1	2
В	0.6	1	Load	1	4
		2	Mill	2	40
		3	Drill	3	15
		4	Unload	1	2

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- OR
- Q.4 (a) Write a note on: Types of AGVs and their applications.
  (b) Discuss the various issues to be considered while (i) planning, (ii) designing, 07 and (iii) operating an FMS.
- **Q.5** (a) Explain the benefits a CIMS offers (any Five).
  - (b) A certain part is produced in a batch size of 100 units. The batch must be routed through five operations to complete the processing of the parts. Average setup time is 3 hr/operation, and average operation time is 6 min. Average non-operation time due to handling, delays, inspections, etc., is 7 hours for the complete batch for each operation. Determine how many days it will take to complete the batch assuming the plant runs one 8-hr shift/day.
  - (c) Define the following production concepts: Production capacity, Availability, Utilization, Manufacturing lead time, and Work-in-process.

## OR

- Q.5 (a) Explain the meaning of the terms: data, information, database, signals, 07 signaling, transmission, and DBMS.
  - (b) Explain the following types of communication lines with regard to CIM: (1) 07 PTP connection, (2) multiplexing.

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