

Mechanical Engineering Department

Session 2018-19

Time: 1 Hr.

7ME6.3A: CNC Machines and Programming

Max. Points:30

Solution

Q-1 Please indicate whether each of the statements is TRUE or FALSE. No marks will be awarded for writing only T or F.

- | | | | | |
|-------------|-------------|-------------|------------|------------|
| (a) – False | (b) – False | (c) – False | (d) – True | (e) – True |
| (f) – True | (g) – True | (h) – False | (i) – True | (j) – True |

Solution 2: Where is NC most appropriate? Also, classify CNC machines (no description).

Solution:

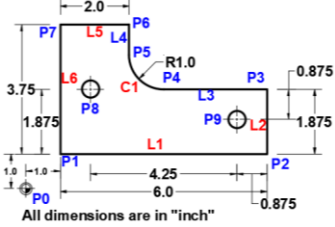
NC is appropriate at following point of time: (it is expected that students should answer at least 5 points of the below mentioned)

- Parts are processed frequently and in small to mediums for sizes.
- Part geometry is complex.
- Close tolerances must be held on the work part.
- Many operations must be performed on the part in its processing.
- Much metal needs to be removed.
- Engineering design changes are likely.
- It is an expensive part where mistakes in processing would be costly.
- Parts require 100% inspection.

Classification of CNC Machine Tools

- a) Based on the motion type ' Point-to-point & Contouring systems
 - i. Point-to-point systems
 - ii. Contouring systems (Continuous path systems)
- b) Based on the control loops ' Open loop & Closed loop systems
 - i. Open loop systems
 - ii. Closed loop systems
- c) Based on the number of axes
 - i. 2& 3 axes CNC machines
 - ii. 4 & 5 axes CNC machines
- d) Based on the power supply
 - i. Electric systems
 - ii. Hydraulic systems
 - iii. Pneumatic systems

Solution 3: APT Program:

<p>(a) Geometric statements PARTNO/Q3ab MACHIN/MILLING 1 CLPRINT CUTTER/0.5 P0=POINT/0.0,0.0,0.0 P1=POINT/1.0,1.0,0.0 P2=POINT/7.0,1.0,0.0 P3=POINT/7.0,2.875,0.0 P4=POINT/4.0,2.875,0.0 P5=POINT/3.0,2.875,0.0 P6=POINT/3.0,4.75,0.0 P7=POINT/1.0,4.75,0.0 P8=POINT/1.875,2.875,0.0 P9=POINT/6.125,2.0,0.0 P10=POINT/3.0, 3.875, 0.0 L1=LINE/P1, P2 L2=LINE/P2, P3 L3=LINE/P3, P4 L4=LINE/P5, P6 L5=LINE/P6, P7 L6=LINE/P7, P1 C1=CIRCLE/CENTER, P10, RADIUS, 1.0 PL1 = PLANE/P1, P2, P3</p>	<p>(b) Motion statements FROM/P0 SPINDL/573 FEDRAT/5.39 COOLNT/ON GO/PAST, L1, TO, PL1, TO, L6 GORGT/L1, PAST, L2 GOUP/L2, PAST, L3 GOLFT/L3, TANTO, C1 GOFWD/C1, TANTO, L4 GOUP/L4, PAST, L5 GOLFT/L5, PAST, L6 GODOWN/L6, PAST, L1 RAPID GOTO/P0 COOLNT/OFF FINI</p>	 <p>All dimensions are in "inch"</p>
---	---	---








Solution:4 Justification to install Adaptive Control Machining System in CNCs

- An AC system measures certain output process variables and uses these to control speed and/or feed of machine.
- AC determines the proper speeds and/or feeds during machining as a function of variations.
- When cutter is engaged more than 40% of the time on the machine,
- For variability in the job by the means of feed and/or speed,
- The cost of operating the machine tool is high,
- The typical jobs and hard materials like steel, titanium and high strength alloys.

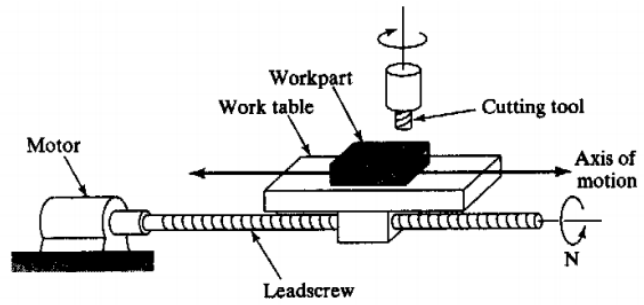
Different sources of variability in machining

- Variable geometry of cut in the form of changing depth of cut,
- Variable workpiece hardness and variable machinability
- Variable workpiece rigidity
- Tool wear increases as the cutting force increases
- Air gaps during cutting

Solution:5 Symbols and name of components/devices

	M	machine zero point
	W	work part zero point
	R	reference point
	E	tool reference point
	B	tool setup point
	A	tool shank point
	N	tool change point

(a) Reference Points and Zeros of CNC Machine



(b) Motor and leadscrew arrangement in NC positioning system or Open loop positioning system