

POSTAL Study Package

2021

Production and Industrial Engineering

Objective Practice Sets

Manufacturing Process-II

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Advanced Machining Methods

- Q.1** The most common interpolation methods in continuous path NC machining are
(a) Linear and circular
(b) Linear and parabolic
(c) Circular and parabolic
(d) Circular and parabolic
- Q.2** In NC part programming spindle speed of 730 rpm will be coded by the magic-3 rule as
(a) S673 (b) S037
(c) S630 (d) S730
- Q.3** With reference to NC machine, which of the following statement is wrong?
(a) Both closed loop and open loop control systems are used.
(b) Paper tapes, floppy drivers and cassettes are used for data storage.
(c) Digitisers may be used as interactive input devices.
(d) Post-processor is an item of hardware.
- Q.4** In which one of the following machining manual part programming is done?
(a) CNC Machining (b) NC Machining
(c) DNC Machining (d) FMS Machining
- Q.5** Interpolation in the controller refers to control of which one of the following in a CNC machine?
(a) Loading and unloading of jobs on machine
(b) Loading and unloading of tools from the tool changer
(c) Axes of machine for contouring
(d) Coolant and miscellaneous functions on machine
- Q.6** Machining centre is
(a) an automatic tool changing unit
(b) a group of automatic machine tools
(c) a next logical step beyond NC machine
(d) an NC machine tool
- Q.7** Which one of the following is standard co-ordinate system for NC/CNC machine tools?
(a) Polar (b) Cylindrical
(c) Cartesian (d) All of these
- Q.8** Several machine tools can be controlled by a central computer in
(a) NC Machine Tool
(b) CNC Machine Tool
(c) DNC Machine Tool
(d) CCNC Machine Tool
- Q.9** The interpolator in a CNC machine controls
(a) Spindle Speed (b) Coolant Flow
(c) Feed Rate (d) Tool Change
- Q.10** Which type of motor is NOT used in axis or spindle drives of CNC machine tools?
(a) Induction motor (b) DC servo motor
(c) Stepper motor (d) Linear servo motor
- Q.11** The device, fed to the control unit of NC machine tool which sends the position command signals to sideway transmission elements of the machine, is called as
(a) Controller (b) Tape
(c) Feedback Unit (d) None of the above
- Q.12** In APT language, the cutter motion in incremental coordinate mode is addressed as
(a) G0/T0/..... (b) G0/T0.....
(c) G0DLTA/.... (d) G0FWD/.....
- Q.13** Which of the following code will give point to point movement?
(a) G00 (b) G01
(c) G54 (d) G40
- Q.14** Which of the following code will produce dwell for a specified time?
(a) G18 (b) G65
(c) G45 (d) G04

- (a) Drilling (b) Tapping
(c) Boring (d) Grooving

- Q.28** In a CNC feed drive, a stepper motor with step angle of 3.6 degree drives a lead screw with pitch of 2 mm. The basic length unit (BLU) (in microns) for the drive is _____
- Q.29** A leadscrew with a 7.5 mm pitch drives a worktable in an NC positioning system. The leadscrew is powered by a stepping motor which has 200 step angles. The worktable is programmed to move a distance of 120 mm from its present position at a travel speed of 300 mm/min. Determine the number of pulses required to move the table for the specified distance.
- Q.30** In Q.29, determine the motor speed (in rpm) to achieve the desired table speed.
- Q.31** In Q.30, determine the pulse rate (in Hz) to achieve the desired table speed.
- Q.32** A stepping motor with 100 step angles is coupled to a lead screw through gear reduction of 9 : 1 (9 rotations of the motor for each rotation of the lead screw). The lead screw has 5 threads per inch (5 TPI). The worktable driven by the lead screw must move a distance = 250 mm in at a feed rate of 720 mm/min. Pitch = 5 mm. Determine the number of pulses required to move the table.
- Q.33** In Q.32, determine the required motor speed (in rpm) to achieve the desired table speed.
- Q.34** In Q.32, determine the pulse rate (in Hz) to achieve the desired table speed.

- Q.35** A NC machine tool table is powered by a servo motor, lead screw and optical encoder. The leadscrew has a pitch = 5 mm and is connected to the motor shaft with a gear ratio of 16 : 1 (16 turns of the motor for each turn of the lead screw). The optical encoder is connected directly to the leadscrew and generates 200 pulses/rev of the leadscrew. The table must move a distance = 100 mm at a feed rate = 500 mm/min. Determine the pulse count received by the control system to verify that the table has moved exactly 100 mm.
- Q.36** In Q.35, determine the pulse rate (in Hz).
- Q.37** In Q.35, determine the motor speed (in rpm) that correspond to the feed rate of 500 mm/min.
- Q.38** A leadscrew connected directly to a DC servo motor is the drive system for a positioning table. The leadscrew pitch = 4 mm. The optical encoder attached to the leadscrew emits 250 pulses/rev. of the leadscrew. Determine, the control resolution of the system, expressed in linear travel distance of the table axis (in mm).
- Q.39** In Q.38, determine the frequency of the pulse train emitted by the optical encoder when the servomotor operates at 14 rev/sec.
- Q.40** In Q.39, determine the travel speed of the table (in mm/sec) at the operating speed of the motor.



Answers		Advanced Machining Methods					
1. (a)	2. (d)	3. (d)	4. (b)	5. (c)	6. (b)	7. (c)	8. (c)
9. (c)	10. (a)	11. (b)	12. (c)	13. (a)	14. (d)	15. (d)	16. (b)
17. (d)	18. (a)	19. (a)	20. (a)	21. (a)	22. (b)	23. (a)	24. (c)
25. (c)	26. (b)	27. (a)	28. (20)	29. (3200)	30. (40)	31. (133.33)	32. (45,000)
33. (1296)	34. (2160)	35. (4000)	36. (333.33)	37. (1600)	38. (0.016)	39. (3500)	40. (56)

Explanations Advanced Machining Methods**1. (a)**

Linear and circular interpolation methods are most commonly used in NC machining.

2. (d)

G-code for spindle speed is denoted by *S*.
∴ *S730* is correct answer

3. (d)

Post processor is not used in NC machine.

4. (b)

In NC Machining, manual part programming is done.

5. (c)

Interpolation in the controller refers to control of axes of machine for contouring in a CNC machine.

6. (b)

In machining centre, a group of automatic machine tool devices are present where versatile operation is performed.

7. (c)

Cartesian co-ordinate system is used in CNC to numerically assign direction and plane of movement.

8. (c)

Direct Numerical Control (DNC) is a process set in a manufacturing unit where a set of machines is controlled by a programmed computer with the help of a direct connection to the same. Set of machines mentioned above use Computer Numerical Control (CNC). It is also called as distributed Numerical Control.

9. (c)

The interpolator in a CNC machine controls feed rate.

10. (a)

Generally, Induction Motor is not used in axis or spindle drives of CNC machine tools.

11. (b)

Tape is a device which fed to the control unit of NC machine tool which sends the position command signals to sideway transmission elements of the machine.

12. (c)

G0DLTA/dx, dy, dz

This is an incremental instruction used to make movement of tool in specified direction from current position.

13. (a)

G00 will give point to point movement. *G00* is also known as rapid or traverse move.

14. (d)

G04 will produce dwell for a specified time.

15. (d)

G03 will give circular interpolation in counter-clockwise direction.

16. (b)

G17 is used to select *xy* plane in milling.

17. (d)

G20 will change specified input values in millimeters.

18. (a)

G90 is used for absolute coordinate system in the programming.

19. (a)

G40 is used to cancel offset compensation for cutter radius.

20. (a)

G32 is used in thread cutting for turning.

21. (a)

G02 code is used for clockwise circular interpolation.

22. (b)

Final point : *X7.0 Y2.0*
Centre point : *I5.0 J2.0*

31. (133.33)

$$f_p = \frac{v_t n_s}{60p} = \frac{300 \times 200}{60 \times 7.5}$$

$$\Rightarrow f_p = 133.33 \text{ Hz}$$

32. (45,000)

$$\text{Step angle, } \alpha = \frac{360^\circ}{n_s} = \frac{360^\circ}{100} = 3.6^\circ$$

Number of pulses required,

$$n_p = \frac{360 r_g \times x}{p \times \alpha} = \frac{360 \times 9 \times 250}{5 \times 3.6}$$

$$\Rightarrow n_p = 45000 \text{ pulses}$$

33. (1296)

$$N_m = \frac{r_g \times f_r}{p} = \frac{9 \times 720 \text{ mm/min}}{5 \text{ mm/rev}}$$

$$\Rightarrow N_m = 1296 \text{ rpm}$$

34. (2160)

$$f_p = \frac{r_g f_r n_s}{60p} = \frac{9 \times 720 \times 100}{60 \times 5}$$

$$\Rightarrow f_p = 2160 \text{ Hz}$$

35. (4000)

$$n_p = \frac{x n_s}{p} = \frac{100 \times 200}{5}$$

$$\Rightarrow n_p = 4000 \text{ pulses}$$

36. (333.33)

$$f_p = \frac{f_r \times n_s}{60 \times p} = \frac{500 \times 200}{60 \times 5}$$

$$\Rightarrow f_p = 333.33 \text{ Hz}$$

37. (1600)

$$N_m = \frac{r_g f_r}{p}$$

$$\Rightarrow N_m = \frac{16 \times 500 \text{ (mm/min)}}{5 \text{ (mm/rev)}}$$

$$\Rightarrow N_m = 1600 \text{ rpm}$$

38. (0.016)

$$CR = \frac{P}{n_s} = \frac{4}{250} = 0.016 \text{ mm}$$

39. (3500)

$$N_m = N_{is} = 14 \text{ rps}$$

because the motor is connected directly to the leadscrew.

$$f_p = N_m n_s$$

$$\Rightarrow f_p = 14 \times 250 \text{ Hz}$$

$$\Rightarrow f_p = 3500 \text{ Hz}$$

40. (56)

$$V_t = N_m \times P = 14 \times 4 \text{ mm/sec}$$

$$\Rightarrow V_t = 56 \text{ mm/sec}$$

