Mechanical CADM - IV unit.

Q1) Explain the Part programming Procedure.

The Part Program for a CNC machine involves a set of controlled algorithms, which are executed by the machine's control unit. The Proposed machining operation on a work part is performed effectively according to the instructions Provided. The various fundamental step that are involved in developing a part program are show.

1. Process planning :- The Part drawings from the design department, details of machinery, Product quantity, estimated time etc. are analysed and the route sheet is prepared.
This route sheet consists of sequence of arrangement of processing and assembly operations to manufacture a part. A high skilled and experienced. Process planner is required for generating Process plan.
2. selection of Axes :- The starting and ending Point of machine cutting tool in a co-ordinate axes system is important for machining. according to the operating sequence. The fixed datum or ref. Position of cutting tool system. axes is selected based on the work. Part geometry. where the actual processing begins.

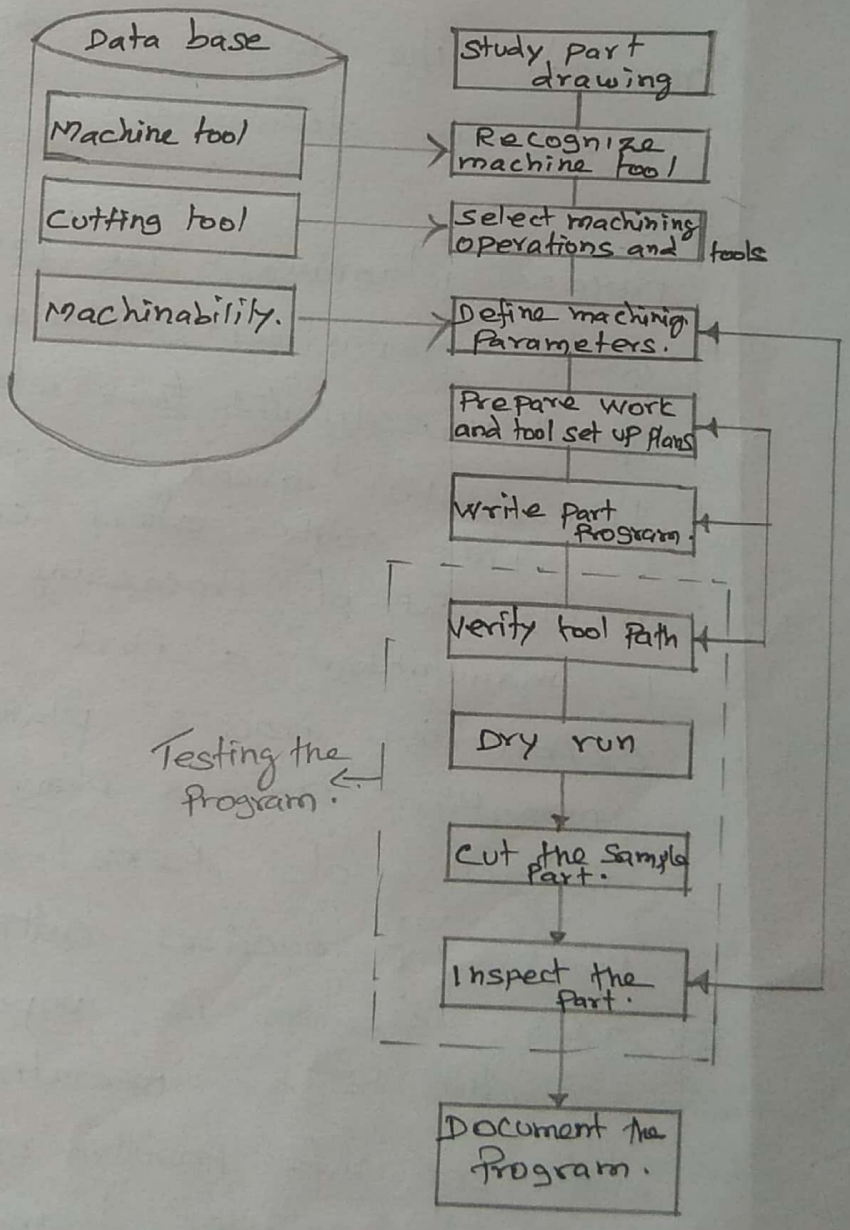
3) selection of machine tool.

The selection of type of machine tool. Suitable for the given operation on the work-part depends on.

i) material of work-part.

ii) Type of operation on the work part.

iii) more economical than other feasible tools.



4) Determining machining Parameters:-

Spindle speed, feed rate and depth of cut are the cutting-process parameters of a machine, which define the quality of a Product. Its change with the selected cutting tool and operation to be performed.

5) Job and Tool set-up planning.

To Perform various type of operations, the CNC machine should be set-up as per the operation.

- Involves tool setup and Job setup.
- Aim of the planning is to locate the cutting tool and work part at appropriate positions for effective machining.

6) Tool-Path planning:- The necessary specifications of manufacturing depends on the machining or tool-path planning. The appropriate machining path is governed by the sequence and type of operations.

7) Part-Program writing:-

Given work part and operations is generated in terms of 'G' and 'M' codes. which is executed by CNC Controller to perform actual machining.

8) Part-Program Testing:-

Before executing the Part-Program for performing actual maching on workpart, the program manuscript should be visually checked in order to obtain

i) Elimination of collisions during processing
ii) Safety of operator and machine.
iii) controlled machining Parameters.

9. Program Documentation.

The progress of CNC manufacturing for a particular workpart is documented in the form of records. Consist of part drawings, route sheets, tool cards, machine setup sheets, programming scripts and punched paper tape.

Q2 Describe the drive systems used in CNC machine tools.

Various drives used in CNC machines,

1) Spindle drives.

It's used to provide the angular motion to the workpiece or cutting tool.

For higher material removal rate – CNCs required high power motors and the speed of the motor should be infinitely variable. This achieved by the use of D.C motors which provide infinitely variable speeds by varying the voltage.

With the developments in the microprocessor controlled frequency converters, the usage of Ac motors in increased in the CNC machine tools.

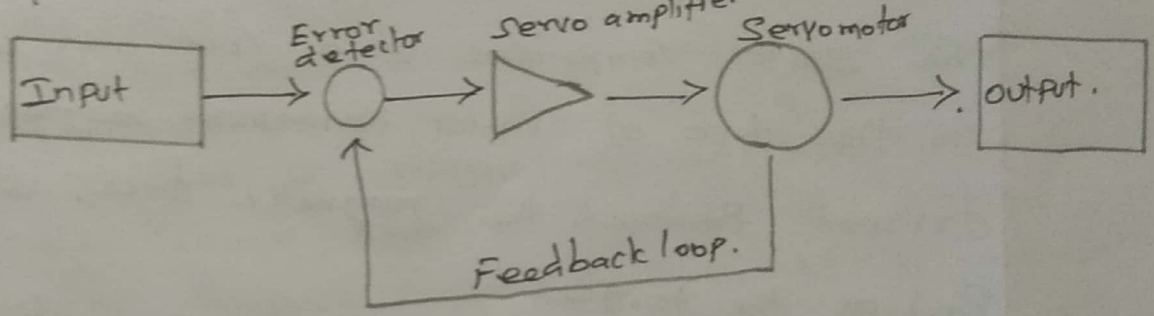
Positioning the spindle axis such as in turn and mill centers also an advantage of using Ac drive

2. Feed Drives. The function of these drives is to drive the axis in CNC (saddle or carriage).

i) DC servomotors.
ii) Brushless DC Servomotors.
iii) AC Servomotors.
iv) Stepper motor.
v) Linear motors.

3) Servomotors.

These are special electro mechanical devices that generates the required degrees of rotation very precisely. A servo is a DC or AC or brushless DC motor with an integrated position sensor. As servomotors are used for controlling the mechanical systems. there are also known as control motors.



Block diagram of servomotor.

The input reference signal is fed to the servo amplifier. which controls the speed of the motor accordig to the input. A feedback device may be an encoder or a resolver is mounted on the motor. which converts the mechanical motion into electrical signal. is used as feedback. that is fed to the error detector. If there is any error a signal is sent to the servo amplifier, which provides the input to the motor such that the error is eliminated.

4) DC Servomotors

These servomotors respond to error signals instantly and accelerate the load equickly.. The DC servo motor is the assembly of following.

four components.

i) DC motor
ii) Gear assembly.
iii) Position Sensing device.
iv) Control circuit.

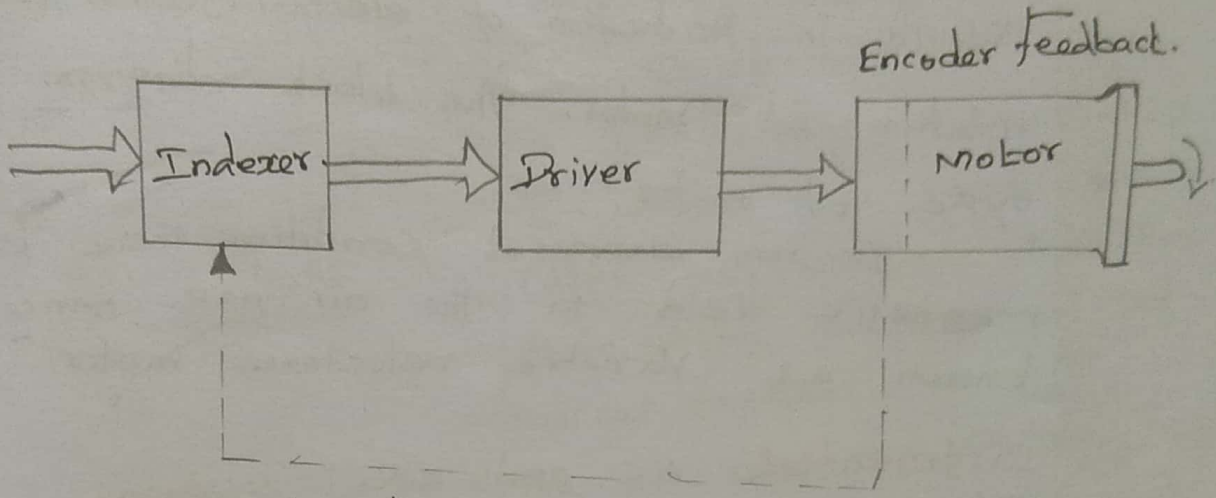
AC Servomotors :—

Rotor of a AC Servomotor Consists of shaft, rotor core and a permanent magnet, and the stator comprises of a core and winding. In this type of motor, Permanent magnet and dc current Produces the magnetic force, which in turn Produces the torque.

Digital encoders such as optical or magnetic type are mounted on these motors which results in high Precision control. As no brushes are used, these are quicker in operation, and available in all sizes.

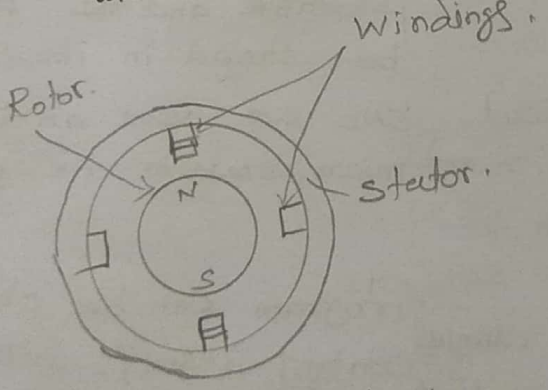
Stepper motor :—

It rotates in fixed angular increments, i.e. the stepper is a pulse-driven motor which changes the angular position of the rotor in steps. These are usually used in open loop Position Control sys. cost associated with these motors is less Compared to other motors.

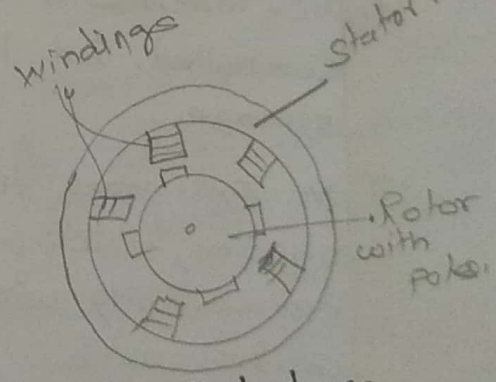


Permanent Magnet Motor.

In this motor, rotor is a permanent magnet This rotor does not have any tooth like other step. motors. The rotor is magnetised at right angle to its axis. Hense, when a current is applied in a sequence to each phase, A, B. C and D. results. in rotation of rotor. These motors operated at Low speeds and high torques. The construction of PM motor.



Permanent Magnet stepper Motor.



Variable Reluctance stepper motor.

Variable Reluctance Motor.

In this motor, the rotor made of soft steel consists of four teeth at 90° apart from each other, and the stator with 6 teeth at 60° apart.

Energizing of stator poles in a sequence results in production of electromagnetic field, thereby rotation of motor. The block diagram of this type of motor is

In non energised condition, there is no magnetic field in the air gap. Hence it is known as Variable reluctance motor.

(23) Differentiate NC and CNC systems.

Numerical control machine was the forerunner of the modern machine tool industry. but is seldomly used in today's manufacturing industry.

Numerical control	Computer Numerical control.
1. NC - system is 'Hard wired'	CNC, control system is "soft wired".
2. NC - machine is numerically controlled, but has no memory storage.	A CNC machine has memory storage and the program can be stored in its control.
3. NC sys. uses fixed logical function, which are built in and permanently wired within the control unit	CNC sys. uses an internal microprocessor i.e a computer.
4. It does not allow any changes to the program using control features.	Program can be changed on the control itself. with instantaneous results.
5. These functions cannot be changed by the Programmer or the machine operator.	The part Programmer or the machine operator can change the program.

6) NC system has fixed wiring of the control logic.	CNC sys contains many registers storing a variety of routines that are capable of manipulating logical functions
7. This system uses punched tapes for input of the program information	This system uses special computer chips as software instructions for storing the programs and logical functions.
8. It requires highly skilled people to operate NC machine.	The accuracy and capability of CNC machine tool is controlled by the number of subsystems that are present in it.

Q4. Explain briefly
1. Linear interpolation.
2. circular interpolation. give two examples for each.

1. Linaar interpolation.
in continuous path when a straight line path is to be generated, then linear interpolation is used. This is the most basic method used in continuous path numerical control machines. The prog. specifies the beginning point and end points of the straight line and the feed rate to be used along the line. G01 is the code in NC machine used for the the Linearpolation.

Ex:- G01 X1.5 Y4.5 F15 xy plane

G01 X-8 Z-05 F10 in xz plane

G01 Y-12 Z0.1 F12 in yz plane

2. circular interpolation.

It is often required to generate continous circular arcs and smooth curved shapes. circular Interpolation method permits prog. of a circular arc by specifying the Parameters such as coordinates of the straight line. the end points coordinates, either the center or radius of the arc and the direction of the cutter along the arc.

Ex:- G02 — circular interpolation in clockwise direction

G02 X10 Y20 R1 on xy plane.

G02 X10 Z5 R1 on xz plane

G02 Y20 Z5 R1 on yz plane.