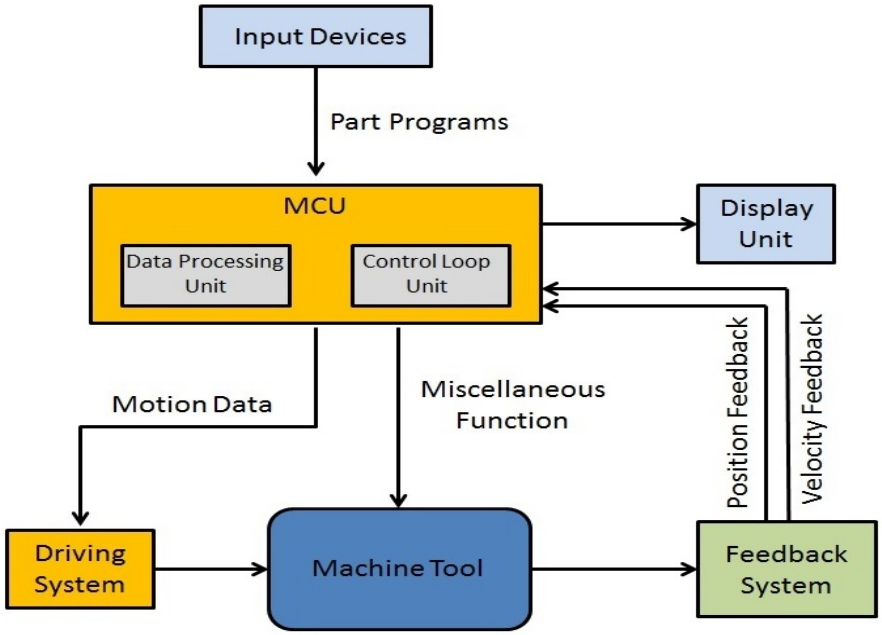
3. With a block diagram explain the working of elements of NC system.

CNC stands for Computer Numerical Control.

When computers are used to control a Numerical Control (NC) machine tool than the machine is called CNC machine. In other words, the use of computers to control machine tools like lathe, mills, slotter, shaper etc is called CNC machine.

Block diagram of NC System.



Working of Elements of NC System.

The main parts of the CNC machine are

(i) Input Devices: These are the devices which are used to input the part program in the CNC machine. There are three commonly used input devices, and these are punch tape reader, magnetic tape reader and computer via RS-232-C communication.

(ii) Machine Control Unit (MCU): It is the heart of the CNC machine. It performs all the controlling action of the CNC machine, the various functions performed by the MCU are

- It reads the coded instructions fed into it.
- It decodes the coded instruction.
- It implements interpolation (linear, circular, and helical) to generate axis motion commands.
- It feeds the axis motion commands to the amplifier circuits for driving the axis mechanisms.
- It receives the feedback signals of position and speed for each drive axis.
- It implements the auxiliary control functions such as coolant or spindle on/off and tool change.

(iii) Machine Tool: A CNC machine tool always has a slide table and a spindle to control of the position and speed. The machine table is controlled in X and Y axis direction and the spindle is controlled in the Z axis direction.

(iv) Driving System: The driving system of a CNC machine consists of amplifier circuits, drive motors and ball lead screw. The MCU feeds the signals (i.e., of position and speed) of each axis to the amplifier circuits. The control signals are than augmented (increased) to actuate the drive motors. And the actuated drive motors rotate the ball led screw to position the machine table.

(v) Feedback System: This system consists of transducers that act as sensors. It is also called a measuring system. It contains position and speed transducers that continuously monitor the position and speed of the cutting tool located at any instant. The MCU receives the signals from these transducers and it uses the difference between the reference signals and feedback signals to generate the control signals for correcting the position and speed errors.

(vi) Display Unit: A monitor is used to display the programs, commands and other useful data of CNC machine.

How CNC Machine Works

- First, the part program is inserted into the MCU of the CNC.
- In MCU all the data process takes place and according to the program prepared, it prepares all the motion commands and sends it to the driving system.
- The drive system works as the motion commands are sent by MCU. The drive system controls the motion and velocity of the machine tool.
- The feedback system records the position and velocity measurement of the machine tool and sends a feedback signal to the MCU.
- In MCU, the feedback signals are compared with the reference signals and if there are errors, it corrects it and sends new signals to the machine tool for the right operation to happen.
- A display unit is used to see all the commands, programs, and other important data. It acts as the eye of the machine.