ADVANCE MACHINE TOOL (429)

ONLY FOR MECHANICAL ENGINEERING

CAPSTAN AND TURRET LATHE

INTRODUCTION

A capstan lathe or a turret lathe is a production lathe used to manufacture any number of identical parts in minimum time .These lathes are development of engine lathes. The capstan and turret lathe are consists of bed, all geared head stock and a saddle on which a four stock station tool post is mounted to hold different tools. A tool post is fixed at the rear end of the carriage holds a parting tool in hand. In a capstan or turret lathes, there is no tail stock but in its place a hexagonal turret is placed. The special characteristics in the capstan or turret lathe enables it to perform a sleek of operation such as turning, drilling, boring, thread cutting, reaming, chamfering off and many other operation.

PRINCIPLE PARTS OF A CAPSTAN & TURRET LATHE

The turret lathe has essentially some parts of the engine lathe expect the turret and complex mechanisms in for make it suitable for mass production work. The following are the essential parts of the capstan and turret lathes.

1. BED

The bed is a long box like casting provided with accuracy guide way upon with are mounted the carriage and turret saddle. The bed is designed to strength, rigidity and permanency of alignment under bed duty service.

2. HEAD STOCK

Head stock is a large casting located at the left end of the bed. The head of a capstan or turret lathe may be as following type..

1. Step cone pulley driven head stock

2. Direct electric motor driven head stock

3. All geared head stock

4. The pre-operative or pre-selective head stock

3. CROSS SLIDE AND SADDLE

In small capstan lathes hand operated cross slide and saddle are used which are clamped in a lathe head at the required position. The larger capstan and heavy duty lathes are equipped with equally to designs a carriage.

1. Convention type

2. Slide type (slide hang type)

4. THE TURRET SADDLE AND AUXILARY SLIDE

In a capstan lathe the turret saddle bridges the gap between two bridges and the top face is accurately machined to provide bearing surface for auxiliary slide. The saddle may be adjusted or the lathe bed way or clamped at the desired position. The hexagonal turret is mounted on the saddle any movement of the turret is attached by power or hand.

CAPSTAN AND TURRET LATHE MACHANISM

The carriage, cross slide, turret slide and the saddle holding the turret may be fed into the work by hand or power. Separate fed transmit power to the carriage and the turret saddle for trip purpose. The various mechanism employed in the lathe are,

1. Turret indexing mechanism

2. Bar feeding mechanism

Turret indexing mechanism is used to index the turret head for each operation

CAPSTAN AND TURRET LATHE SIZE

The size of the capstan and turret lathe is designed by the maximum diameter of the that can be passed through the head stock spindle and the swing diameter of the work that can be rotate over the bed ways in order to specify the lathe fully other important parts such as number of spindle speed and number of head available to carriage and turret spindle.Net weight of the machine floor space and power required etc.

WORK HOLDING DEVICES

Work is supported at the spindle and by the help of chucks and fixtures. The useful methods of holding work in capstan lathe or turret lathe are

1. Jaw chuck

2. Collet chuck

3. Fixture

1. JAW CHUCK

The jaw chucks are used in capstan lathe having two or four jaws. Depending upon the shape of the work, the jaw chucks are used to support odd size jobs having larger diameter which cannot be introduce through the head stock spindle and gripped by collet chuck.

2. COLLET CHUCK

The collet chuck are used for gripping bar introduced through head stock spindle of the capstan lathe or turret lathe and is one of the most common method of holding the work on the chuck may be operated by hand power.

3. FIXTURE

A fixture may be described as a special chuck built up for the purpose of holding, locating and machining large number of identical parts which cannot be easily held by conventional gripping devices. Fixtures also serve the purpose of accurately locating the machining.

TOOL HOLDING DEVICES

The wide variety of work performed in a capstan or turret lathe. In most production necessitated designing of much different type of tool holders may be for holding tools for typical operations. The tool holders may be used for mounted on turret faces or cross slide tool post and may be used for both bar any chuck work while box tools for both are perpendicularly adapted in bar work. The four types of tool holding devices are…

1. Straight cutter holder

2. Adjustable cutter holder

3. Offset cutter holder

4. Multiple cutter holders

CAPSTAN OR TURRET LATHE TOOLS

The different type of tool mounted on the tool holders on the turret face and tools mounted on the cross slide are similar in construction and that of centre lathe job tools. The standard tool listed for different operations are…

1. Turning tool
2. Facing tool
3. Parting tool
4. Chamfering tool
5. Bar ending tool
6. Forming tool

7. Boring tool
8. Reaming tool
9. Carrier base
10. External thread cutting tool
11. Drill
12. Work stop
13. Internal thread cutting tool.

DIFFERENCE BETWEEN CAPSTAN OR TURRET LATHE AND ENGINE LATHE

ENGINE LATHE	CAPSTAN OR TURRET LATHE
• Low HP motor is employed • Number of speeds are less • Only single tool is possible • A tail stock is used to supported to work • Only one cut can be hold at time • Tool bar to be changed after each operation • Employed for single piece production • Production rate is less.	• High HP motor is employed • Wide range of speed • Multiple tool can be mounted • A turret is used to support the work • Combination of cut are possible • Tool can be presented • Used for both production • High production rate.

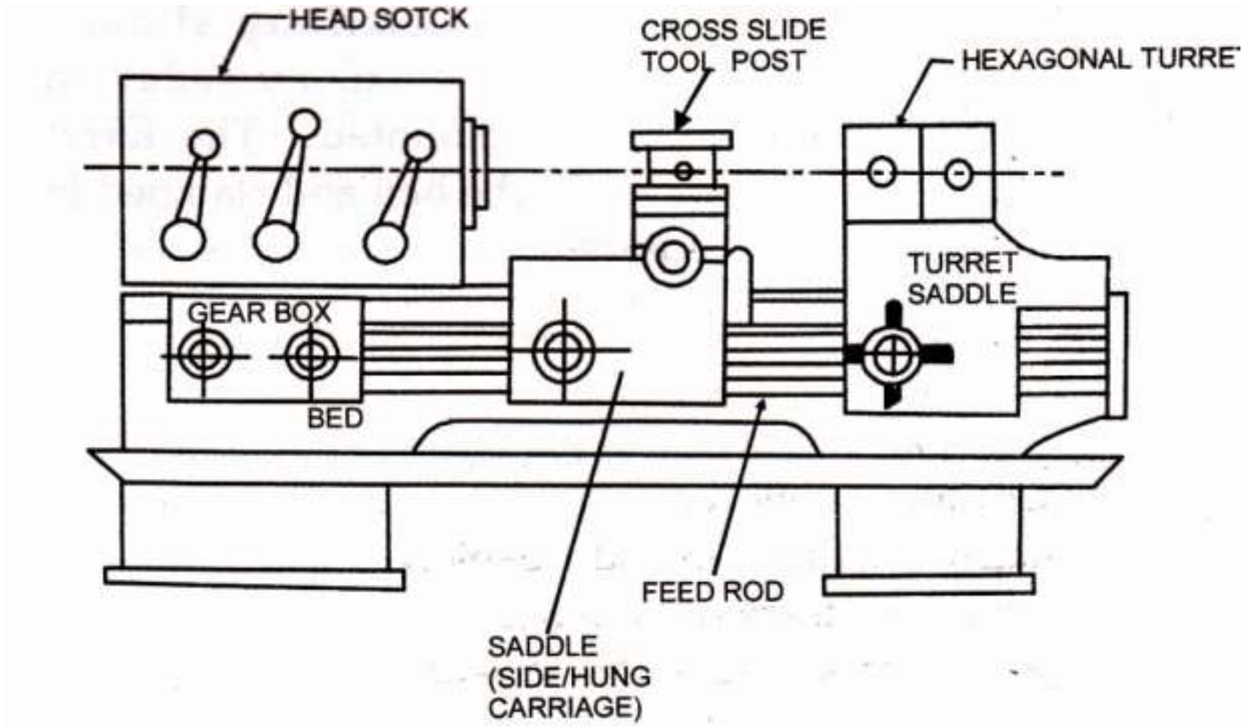


Fig. 1.2 PARTS OF TURRET LATHE

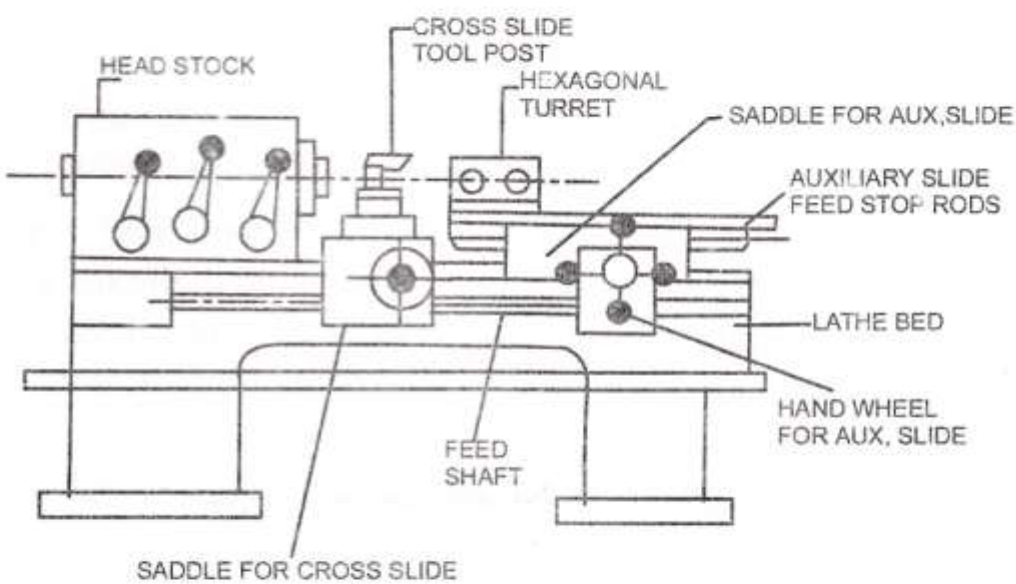


Fig. 1.1 PARTS OF CAPSTAN LATHE

CNC MACHINES

Now a day's NC & CNC machines are performing an important role in manufacturing industry. Numerical control (NC) may be defined as controlling of a machine by means of numbers, letters & symbols. In NC numbers form a program of instructions designed for a particular work part or job.

By the rapid development in the field of electronics has made easy to build efficient and reliable control, now a day's control system built with micro processors with dedicated software consist heart of CNC machines.

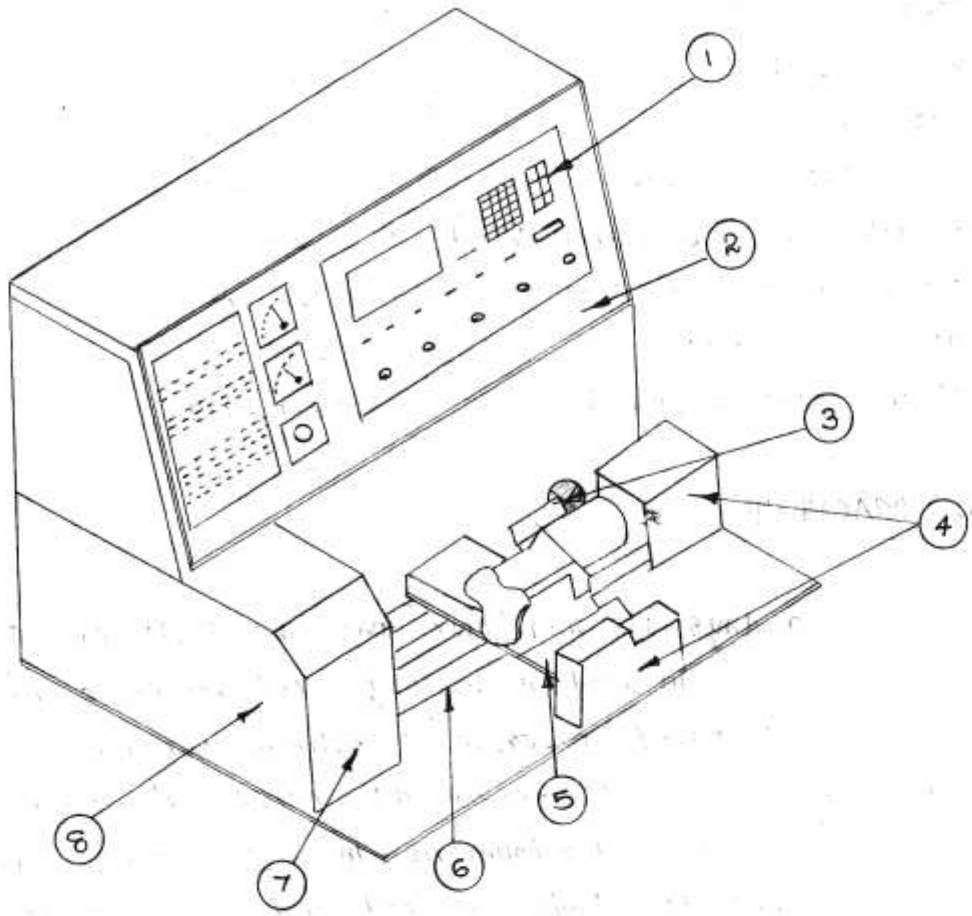
During manufacturing of parts in a machine tool the required size and shape are achieved by performing relative motion between work piece and tool. For getting the identical most accurate product continually the relative motion is not achieved by the hand operation by the operators. More over which is taken more time and require high skill. These factors ultimately lead to low production rates on conventional machines. To overcome these problems CNC machines are used.

In the case of CNC machines the movements are obtained by DC/AC servomotors or DC stepper motors. The selection of right tool for various operations is performed by an indexing device called ATIT (Automatic tool indexing turret) in order to minimize the cycle time various machine activities are executed simultaneously by CNC control

A full flanged CNC machines is expensive and machine hour rates very high, hence it is uneconomical to use it for training also any mistake of the learner may lead to the damage of machine. Thus operator has to be familiar to CNC system for increasing his level of confidence, before operating the full flanged CNC machines. It is achieved by use of CNC trainer lathe.

The CNC machine in our institution is a two axis(X, Z) trainer lathe with FANUK based program

CNC TRAINER LATHE - T100

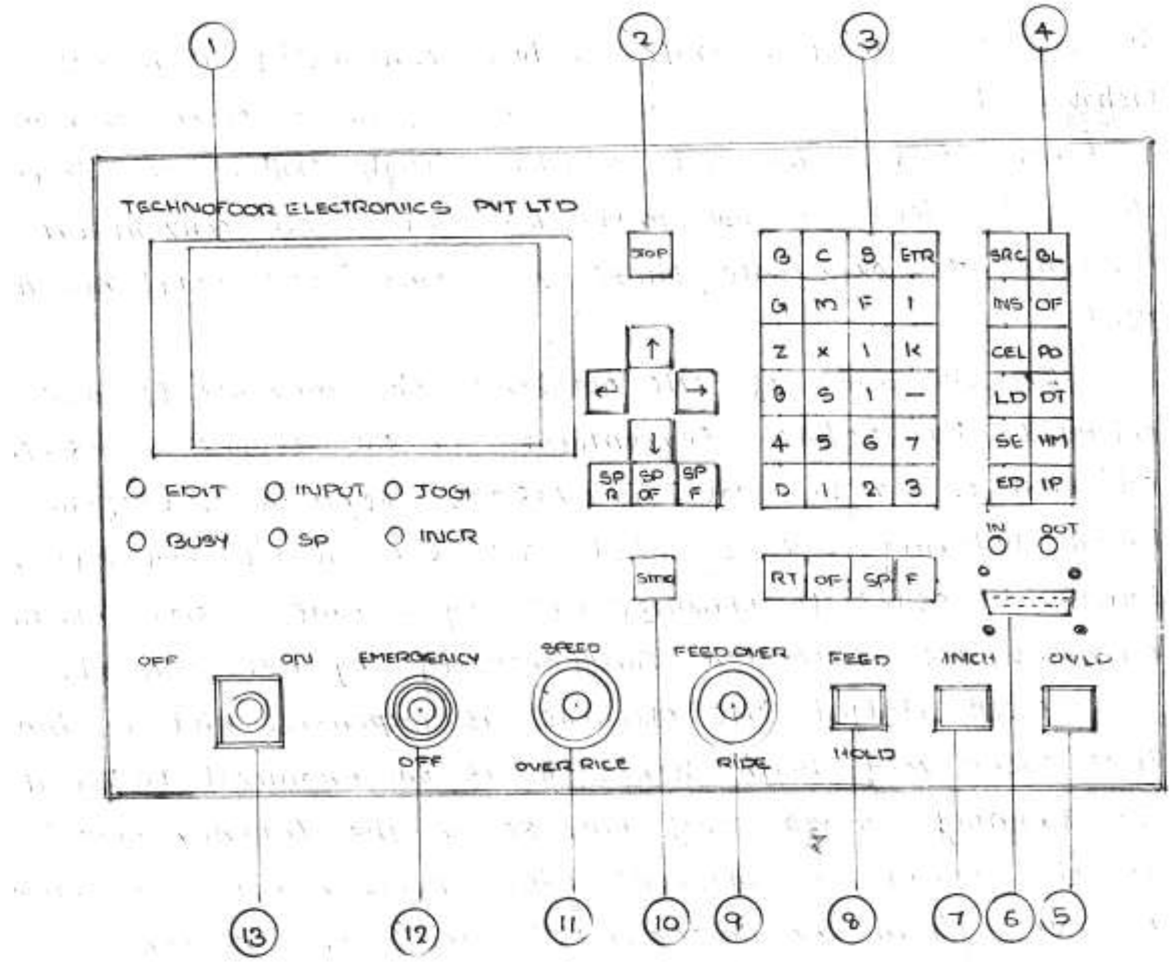


1 KEY BOARD   2 DISPLAY PANEL   3 TAIL STOCK

4 X Y DRIVING SYSTEM   5 SADDL & CROSS SLID   6 BED

7 HEAD STOCK   8 SPINDLE DRIVE SYSTEM

FRONT PANEL OF CNC 2LX CONTROLLER



1 G CODE CHART AND FEED CHART

2 EMERGENCY STOP KEY

3 FUNCTION KEYS

4 FUNCTION KEYS

5 OVER LOAD INDICATION

6 RS 232 C PORT

7 INCH INDICATION

8 FEED HOLD

9 FEED OVER RIDE

10 START KEY

11 SPEED OVER RIDE

12 MASHROOM SWITCH

13 KEY LOCK SWITCH

CNC PROGRAMING

With CNC the program is entered once and then stored in the computer memory. t is required to feed the instructions/programs in the form of letters and numbers which represents some information's or operations.

For example:-

1. **N - NUMBER OF BLOCK**
2. **G - PREPARATORY FUNCTIONS (G CODES)**
3. **X - LINEAR X-AXIS MOTION**
4. **Z - LINEAR Z-AXIS MOTION**
5. **K - CANNED CYCLE AND CIRCULAR OPTIONAL DATA**
6. **F - FEED RATE**
7. **T - TOOL SELECTION CODE**
8. **S - SPINDLE SPEED COMMAND**
9. **M - M CODE MISCELLANEOUS FUNCTIONS**
10. **C - FIFTH AXIS ROTARY MOTION**
11. **B - LINEAR B-AXIS MOTION**

In CNC programming the information's about an operation which would be necessary to be conveyed to the controller for the machine tool operation would consist of the following

1. Operation number
2. Operation code
3. Coordinates for position or motion
4. Tool information
5. Speed and feed for operation

6 Miscellaneous information's like spindle rotation(clockwise/anticlockwise) coolant on/off etc

In a programmed this entire information is called a block

There are two types of programming according to tool indexing

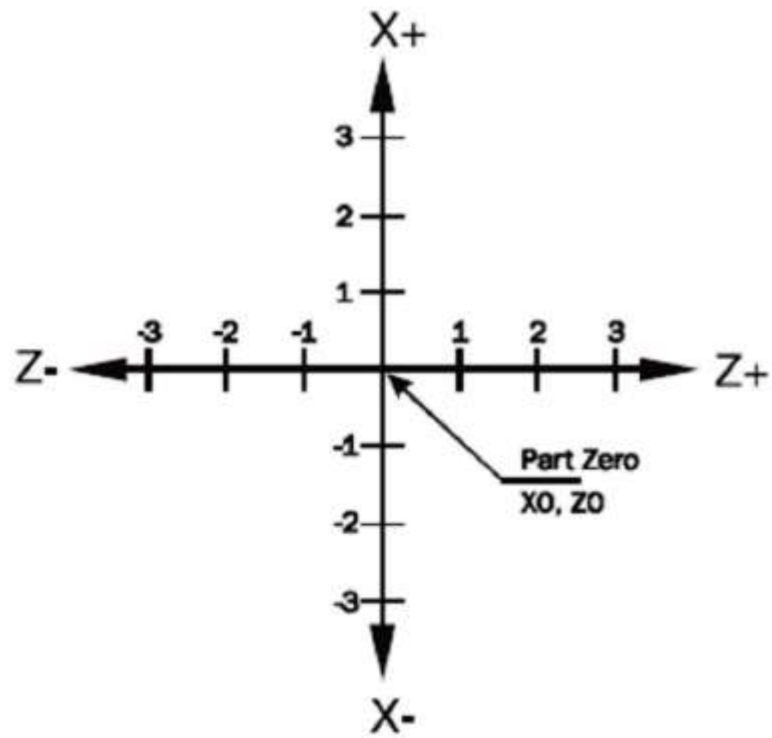
1 Absolute programming (G90)
2 Incremental programming (G91)

In absolute programming only one reference or origin for tool indexing. In this case not consider the current position of tool.

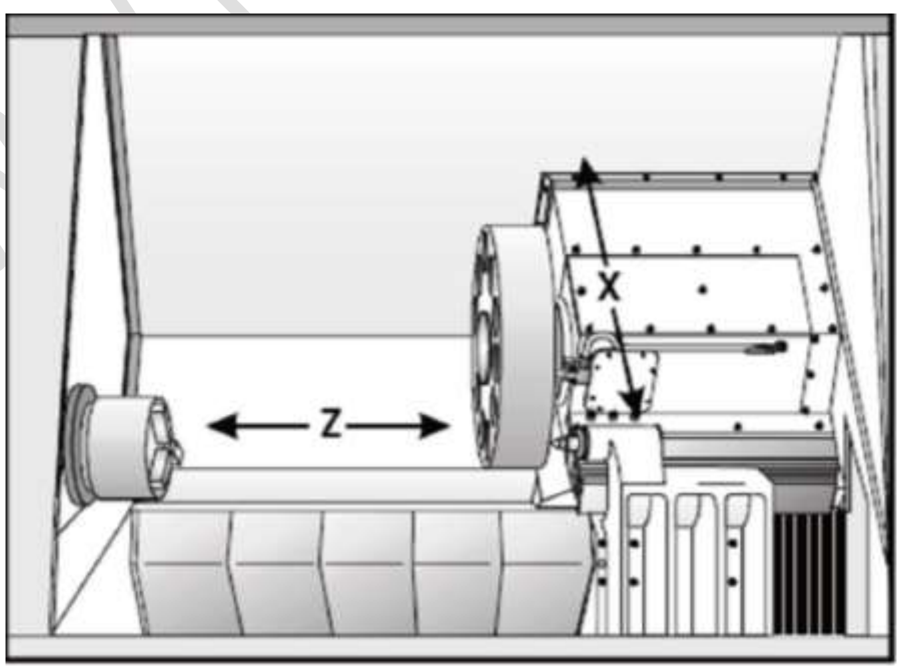
In incremental programming no specific reference point or origin for tool indexing. Here the current position of the tool is to be considered.

COORDINATE SYSTEM

All CNC machines move tools to specific locations described by coordinate systems. With lathes the coordinate system can be simply described as two number lines that intersect. The figure shows two number lines that intersect at a location described as reference zero or Absolute Zero. With lathes the vertical number line is called the X-axis. The horizontal number line is called the Z-axis. The up and down motion or X-axis corresponds to the vertical number line. The Z-axis or side to side motion corresponds to the horizontal number line. The intersection of the two lines is Absolute Zero. When programming lathes X0 is always the centerline of the part you are working on. It is the X position on the Z axis that the part rotates around. Z0 normally is the front finished face of the part.



X-Z AXIS LATHE



G CODES
G00-Point to point positioning
G01-Linear inter relation
G02-Clock wise circular interpredation
G03-Counter Clock wise circular interpredation
G04-Dwell
G05-Hole
G17-X,Y Plane section
G18-z,x Plane section
G19-YZ Plane section
G33-Thread cutting
G63-Tapping
G78-Milling
G81-Turning cycle or Drill cycle
G91-Incremental
G90-Absolute datum
G92-Absolute preset

M CODES
M00-Program stop
M02-End of program
M05-Spindle off
M06-Tool change
M39-Auto cycle
M03-Spindle direction in clock wise
M13-End of program

ADVENTAGES OF CNC MACHINES

1 Reduction in lead time of starting production,
2 Avoiding of operator error,
3 Reduction In operator activity and fatigue,
4 Lower labor cost,
5 Economic production for small and medium batch,
6 Long tool life,
7 Flexibility in change of component design,
8 Reduction in inspection,
9 Reduction in rejection,
10 Accurate costing and scheduling,

11 Semiskilled operator can work,
12 High repeatability and accuracy.

AIMS FOR CNC TRAINING

01 To be familiar with operations of CNC machines
02 To learn theoretical concepts of programming
03 To increase the confidence level of operators
04 To edit and execute programmed on the machines
05 To know requirements and peripherals for optimum CNC machining
06 To understand the basic of CAD/CAM and FMS compatibility