LABORATORY MANUAL

MANUFACTURING TECHNOLOGY –II LAB

ME-319-F

ME- 319 F MANUFACTURING TECHNOLOGY –II LAB.

LIST OF EXPERIMENTS

Experiment 1

Aim: Study and Practice of Orthogonal & Oblique Cutting on a Lathe.

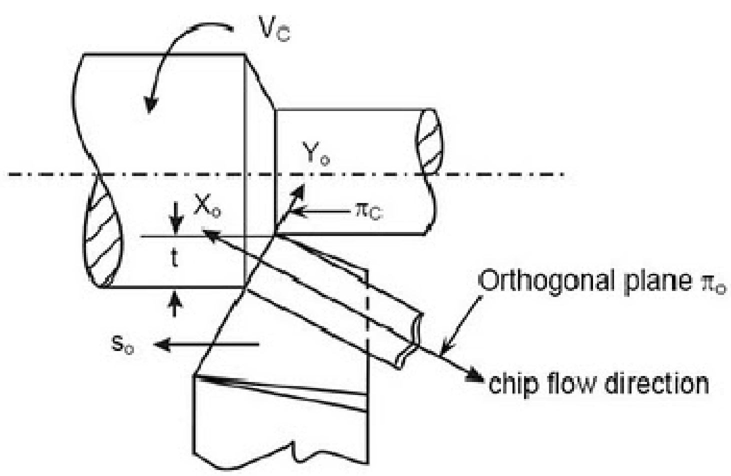
Apparatus: Lathe Machine

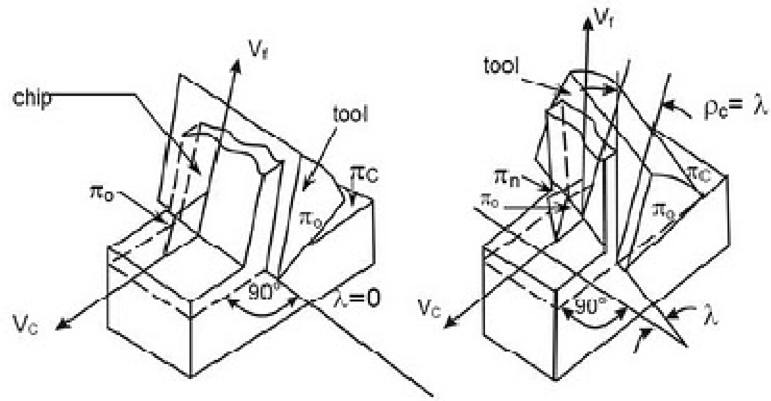
Theory:

It appears from the diagram in the following figure that while turning ductile material by a sharp tool, the continuous chip would flow over the tool's rake surface and in the direction apparently perpendicular to the principal cutting edge, i.e., along orthogonal plane which is normal to the cutting plane containing the principal cutting edge. But practically, the chip may not flow along the orthogonal plane for several factors like presence of inclination angleλ, etc. The role of inclination angle λ on the direction of chip flow is schematicallyshown in figure which visualizes that,

• when λ=0, the chip flows along orthogonal plane, i.e, $\rho = 0$

• when $\lambda \neq 0$, the chip flow is deviated from π and $\rho = \lambda$ where ρ is chip flow deviation (from π) angle





(a) $\lambda = 0$ (b) $\lambda \neq 0$

Orthogonal cutting: when chip flows along orthogonal plane, π , i.e., $\rho = 0$

Oblique cutting :when chip flow deviates from orthogonal plane, i.e. $\rho \neq 0$ But practically ρ may be zero even if $\lambda = 0$ and ρ may not be exactly equal to λ even if $\lambda \neq 0$. Because there are some other (than λ) factors also which may cause chip flow deviation.

Result: Hence the study of Orthogonal & Oblique Cutting on a Lathe is completed.

Experiment 2

Aim: Machining time calculation and comparison with actual machining time while cylindrical turning on a Lathe and finding out cutting efficiency.

Apparatus: Lathe Machine

Theory:
The major aim and objectives in machining industries generally are;
• reduction of total manufacturing time, T
• increase in MRR, i.e., productivity
• reduction in machining cost without sacrificing product quality
• increase in profit or profit rate, i.e., profitability.
Hence, it becomes extremely necessary to determine the actual machining time TC required to produce a job mainly for,
• assessment of productivity
• evaluation of machining cost
• measurement of labour cost component assessment of relative performance or capability of any machine tool, cutting tool, cutting fluid or any special or new techniques in terms of saving in machining time. The machining time, TC required for a particular operation can be determinedroughly by calculation i.e., estimation or precisely, if required, by measurement. Measurement definitely gives more accurate result and in detail but is tedious and expensive.Whereas, estimation by simple calculations though may not be that accurate, is simple,quick and inexpensive. Hence, determination of machining time, specially by simple calculations using suitable equations is essentially done regularly for various purposes.

Procedure:
The factors that govern machining time will be understood from a simple case of machining.
A steel rod has to be reduced in diameter from D1 to D2 over a length L by straight turning in a centre lathe as indicated in Fig.

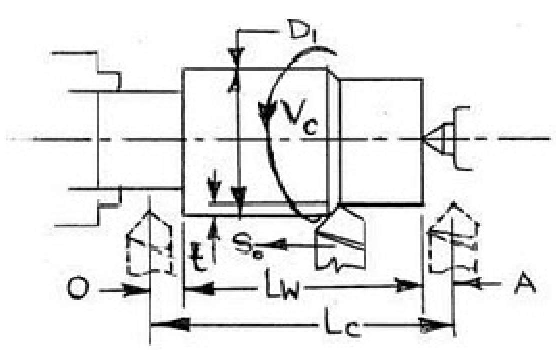


Fig. *Estimation of machining time in turning.*

Calculations:

Sl No	L	A	O	L_C	V_C	D	N	S_O	D1	D2	T	n_p	T_c

Where,

L= length of the work piece in mm;
A= approach run in mm;
O= over run in mm;
Lc=actual length of cut in mm;
Vc= cutting velocity in mm/min;
D= diameter of the job before cut in mm;
N=spindle speed in rpm;
So= tool feed in mm/rev;
D1= initial diameter before passes in mm;
D2=final diameter after passes in mm;
t=depth of cut in one pass in mm;
np=no of passes;
Tc=machining time in min;

Result: The machining time of the turning operation is done and compared.

Experiment 3

Aim: To study the Tool Life while Milling a component on the Milling Machine.

Apparatus: Milling Machine

Theory:

Tool life: Time of cutting during two successive milling or indexing of the tool.
Tool life is thelength of cutting time that a tool can be used or a certain flank wear value has occurred(0.02”).
Taylor’s tool life equation:
$vT^n = C$
v = cutting speed
n = cutting exponent
C = cutting constant
T = tool life
n and C depend on speed, work material, tool material, etc.
Cutting Speed can be obtained by the formula as shown:
$N= (v*1000) / (\pi*d)$
Where :
N=spindle speed in rpm;
v=cutting speed in m/min;
d=diameter of cutter in mm;

Procedure:
1. Determine the cutting speed by using given d and N values.
2. Apply Taylor’s equation and the n and C values, we can solve for tool life.

Calculations:

Sl No	n	C	d	N	V	T

Result: Thus the tool life of milling cutter is found out.

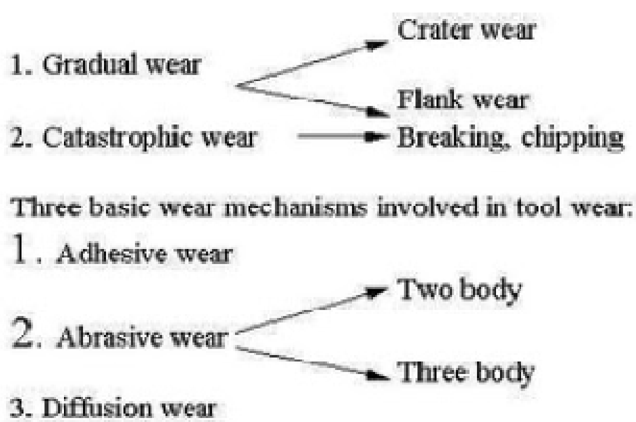
Experiment 4

Aim: To study Tool wear of a cutting tool while Drilling on a Drilling Machine.

Apparatus: Drilling Machine

Theory:

Tool wears are classified as shown below



Result: Study of the tool wear of cutting tool on drilling machine is completed.

Experiment 5

Aim: To study the Speed, Feed, Tool, Preparatory (Geometric) and miscellaneous functionsfor NC part programming

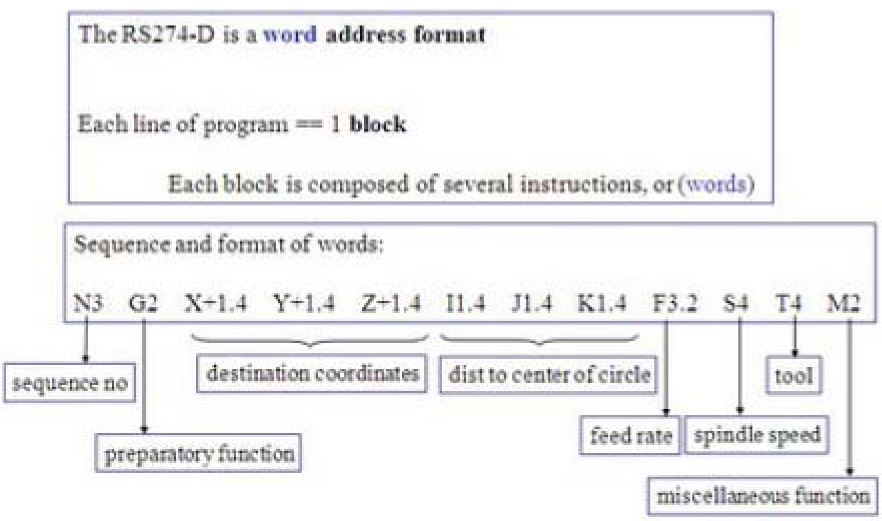
Apparatus: NC Machine

Theory:

Part program: A computer program to specify
- Which tool should be loaded on the machine spindle?
- What are the cutting conditions (speed, feed, coolant ON/OFF etc.)
- The start point and end point of a motion segment.
- How to move the tool with respect to the machine.

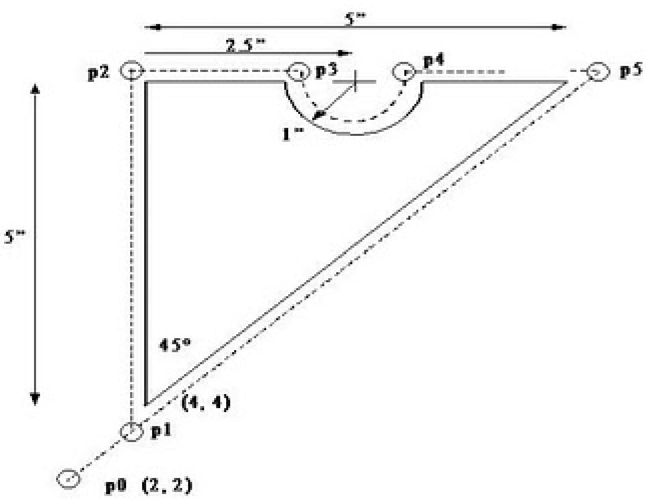
Standard Part programming language: RS 274-D (Gerber, GN-code)

Controlling a CNC machine: RS 274



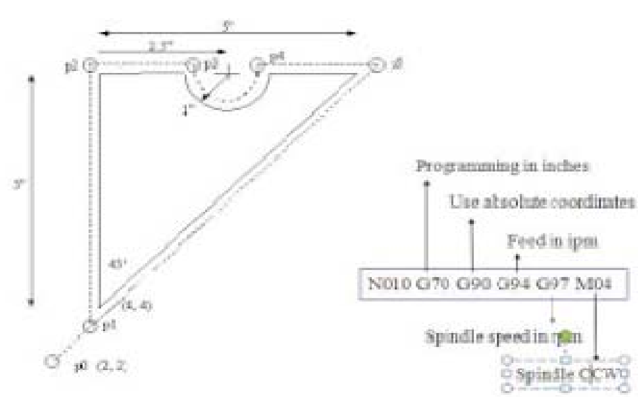
Procedure:

Part Programming Example

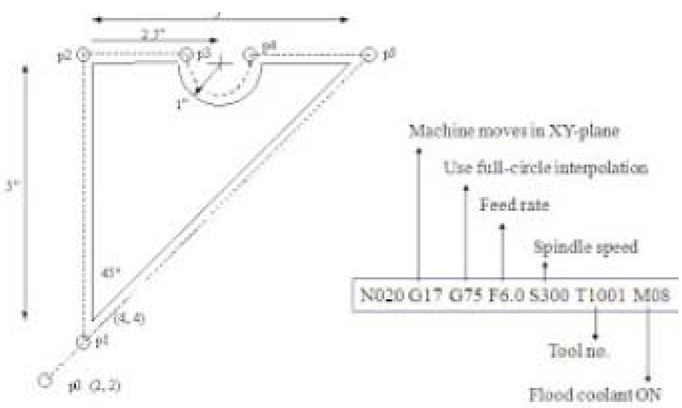


Tool size = 0.25 inch,
Feed rate = 6 inch per minute,
Cutting speed = 300 rpm,
Tool start position: 2.0, 2.0
Programming in inches
Motion of tool:
p0 à p1 à p2 à p3 à p4 à p5 à p1 à p0

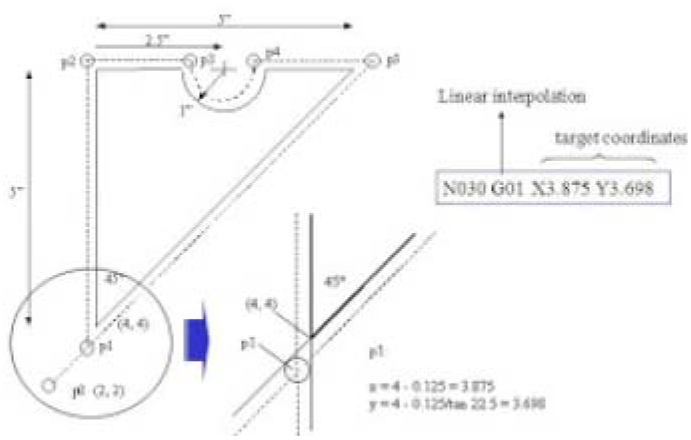
1. Set up the programming parameters



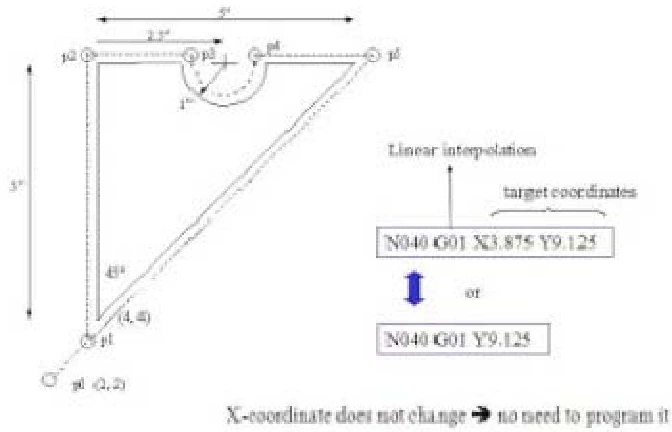
2. Set up the machining conditions



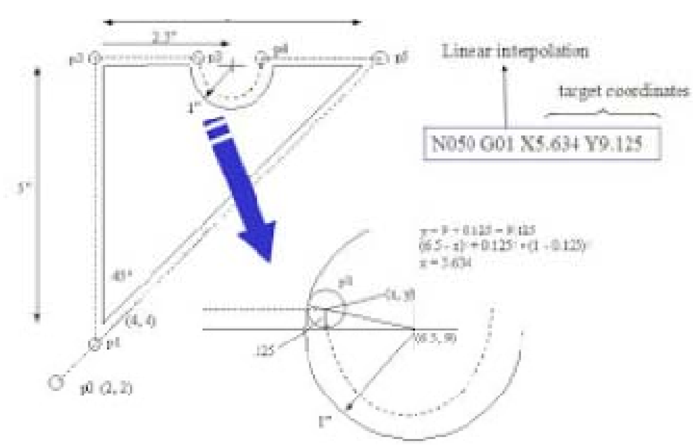
3. Move tool from p0 to p1 in straight line



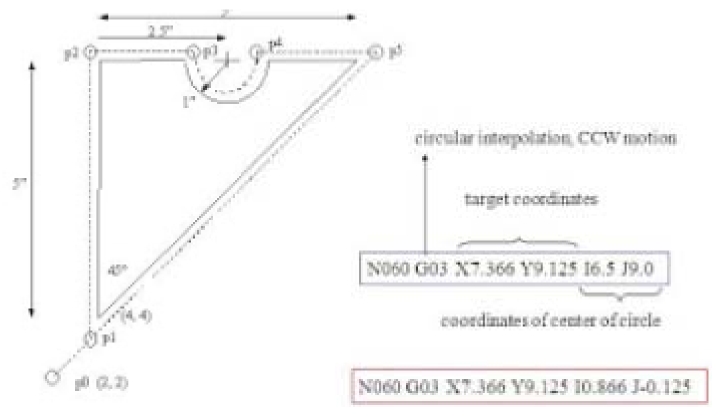
4. Cut profile from p1 to p2



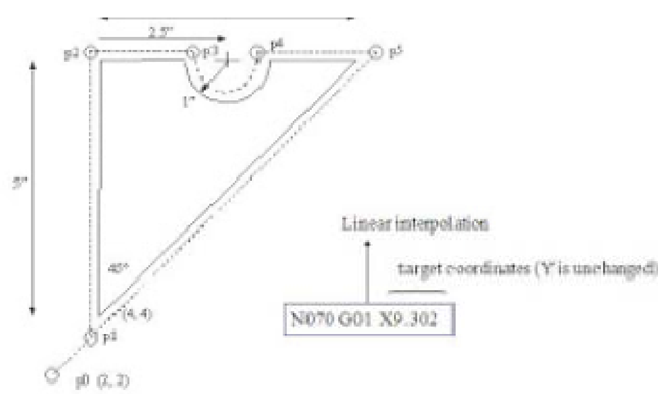
5. Cut profile from p2 to p3



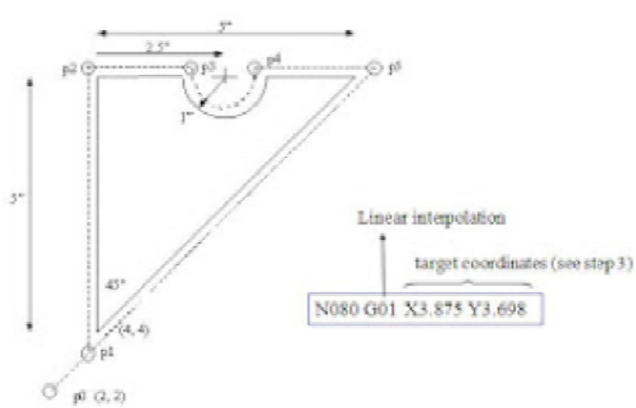
6. Cut along circle from p3 to p4



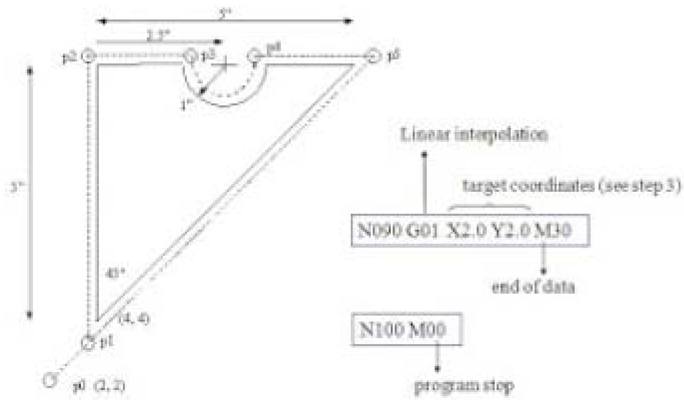
7. Cut from p4 to p5



8. Cut from p5 to p1



9. Return to home position, stop program



10. Complete RS-274 program

N010 G70 G90 G94 G97 M04
N020 G17 G75 F6.0 S300 T1001 M08
N030 G01 X3.875 Y3.698
N040 G01 X3.875 Y9.125
N050 G01 X5.634 Y9.125
N060 G03 X7.366 Y9.125 I0.866 J-0.125
N070 G01 X9.302
N080 G01 X3.875 Y3.698
N090 G01 X2.0 Y2.0 M30

Result: Hence the study of NC part programming is completed.

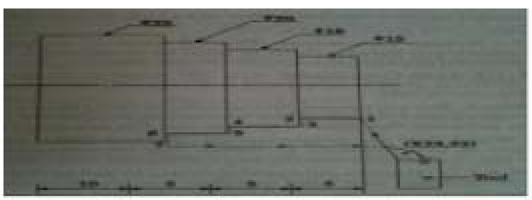
Experiment 6

Aim: To study Part Programming and proving on a NC lathe for:-
a. Outside Turning
b. Facing and Step Turning
c. Taper Turning
d. Drilling
e. Outside Threading

Apparatus: NC Lathe Machine

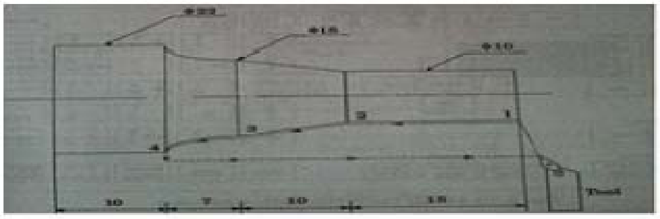
Procedure:

Example for step turning.



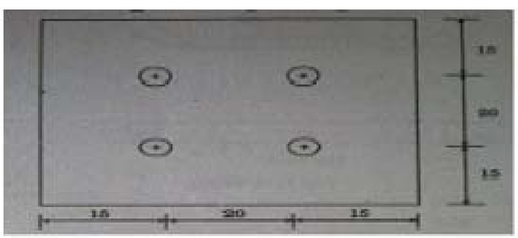
[illegible]	Programme number
BILLET X22 Z30	Billet size
N10 G21 G98 EOB	Feed & depth of cut in MKs units
N20 G28 U0 W0 EOB	Tool post home position
N30 M06 T0202 EOB	Tool number
N40 M03 S1200 EOB	Speed of the spindle
N50 G00 X23 Z2 EOB	Rapid feed to start position
N60 G71 U0.25 R1 N70 G71 P80 Q130 U0.1 W0 F60 EOB	Multi turning operation, 0.25 depth of cut, 1 mm tool retraction, 0.1 mm finishing allowance, 6.0 mm/min feed, from line N80 to N130
N80 G01 X15 EOB	Linear motion of the tool N80 to N130 lines path indicates the corner points 1 to 7 in the figure
N90 G01 X15 Z-5 EOB	
N100 G01 X18 Z-5 EOB	
N110 G01 X18 Z-10 EOB	
N120 G01 X20 Z-10 EOB	
N130 G01 X20 Z-15 EOB	
N140 G70 P80 Q130 F30 EOB	Finishing cycle
N150 G28 U0 W0 EOB	Home position of the tool post
N160 M05 EOB	Spindle stop
N170 M30 EOB	END OF THE PROGRAMME

Example for taper turning.



[illegible]	Programme number
BILLET X22 Z45	Billet size
N10 G21 G98	Feed & depth of cut in MKS units
N20 G28 U0 W0	Tool post home position
N30 M06 T0202	Tool number
N40 M03 S1200	Speed of the spindle
N50 G00 X23 Z2	Rapid feed to start position
N60 G71 U0.25 R1	Multi turning operation, 3.25 depth of cut, 1 mm tool retraction, 0.1 mm finishing allowance, 60 mm/min feed, from line N60 to N130
N70 G71 P80 Q120 U0.1 W0 F60	
N80 G01 X10	Linear motion of the tool
N90 G01 X10 Z-15	
N100 G01 X15 Z-25	
N110 G03 X22 Z-32 R7	Counter clockwise are X22
N120 G01 X22 Z-42	
N130 G70 P80 Q120	Finishing cycle
N140 G28 U0 W0	Home position for the tool post
N150 M05	Spindle stop
N160 M30	END OF THE PROGRAMME

Example for taper Drilling.

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N01 G90 EOB
N02 G17 EOB
N03 M06 EOB
N04 G01 X15 Y15 F60 EOB
N05 L701 EOB
N06 G01 X15 Y35 F60 EOB
N07 L701 EOB
N08 G01 X35 Y35 EOB
N09 L701 EOB
N10 G01 X35 Y15 F60 EOB
N11 L701 EOB
N12 G01 Z5 F10 EOB
N13 G00 X0 Y0 EOB
N14 M05 EOB
N15 M30 EOB
```

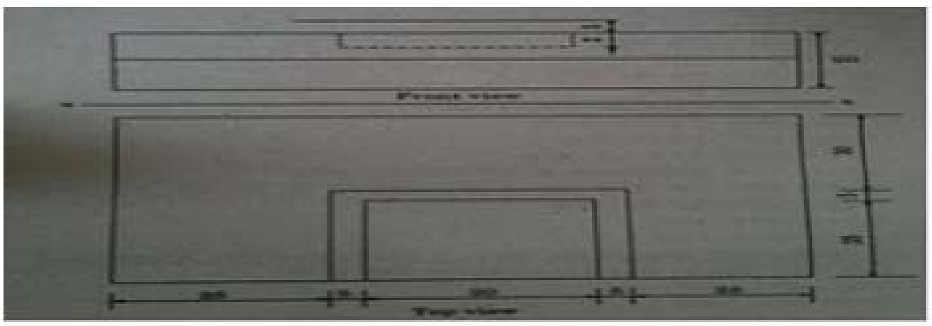
Result: Hence, the study of NC programming is completed.

Experiment 8

Aim: To study Part Programming and Proving for Milling a Rectangular Slot on a NC Milling Machine.

Apparatus: NC Milling Machine

Procedure:



```
N01 G90 EOB
N02 G17 EOB
N03 M06 EOB
N04 M04 S1200
N05 G01 X27.5 Y-7.5 F30 EOB
N06 G01 Z-5.6 EOB
N07 L601 EOB
N08 Z-6.3 EOB
```

```
N09 L601 EOB N140 M17 EOB
N10 Z-7.0 EOB
N11 L601 EOB
N12 Z5 EOB
N13 G0 X0 Y0 EOB
N14 M05 EOB
N15 M30 EOB
```

Result: Hence the study the part programming on a NC Milling Machine for a Rectangular Slot.

Experiment 7

Aim: To study the Part Programming and Proving on a NC Milling Machine:-
a. Point to Point Programming
b. Absolute Programming
c. Incremental Programming

Apparatus: NC Milling Machine

Procedure: