

**1 . Write a Manual Part Program for the diagram shown below.**

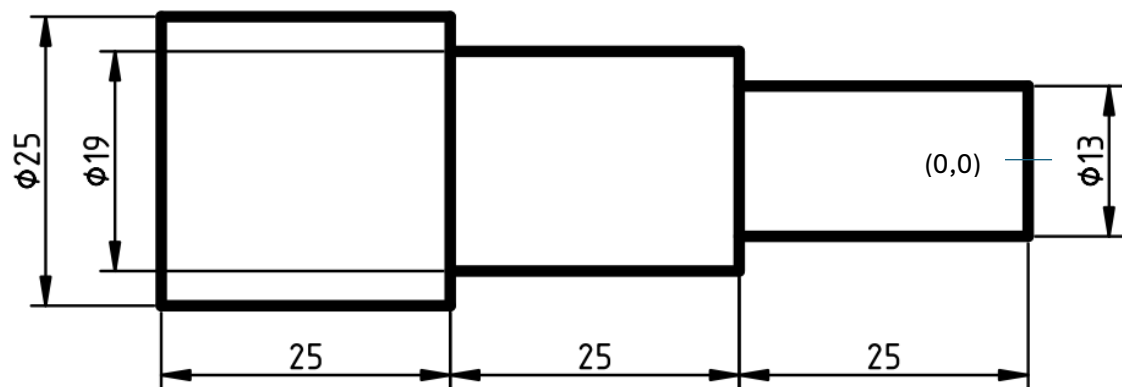
Billet Size :  $\phi$  25 x 75 mm

Tool and tool offset : T0101

Spindle speed : 2000 rpm

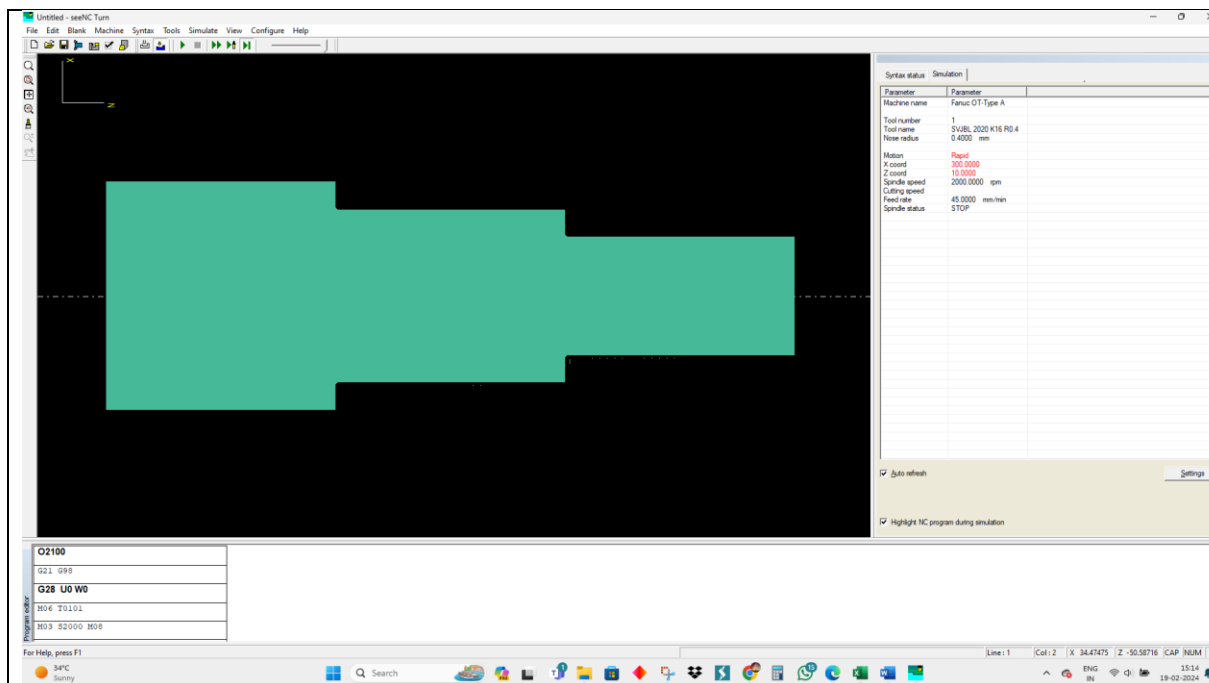
Depth of cut: maximum 2 mm

Co-ordinate format : ( X,Z )



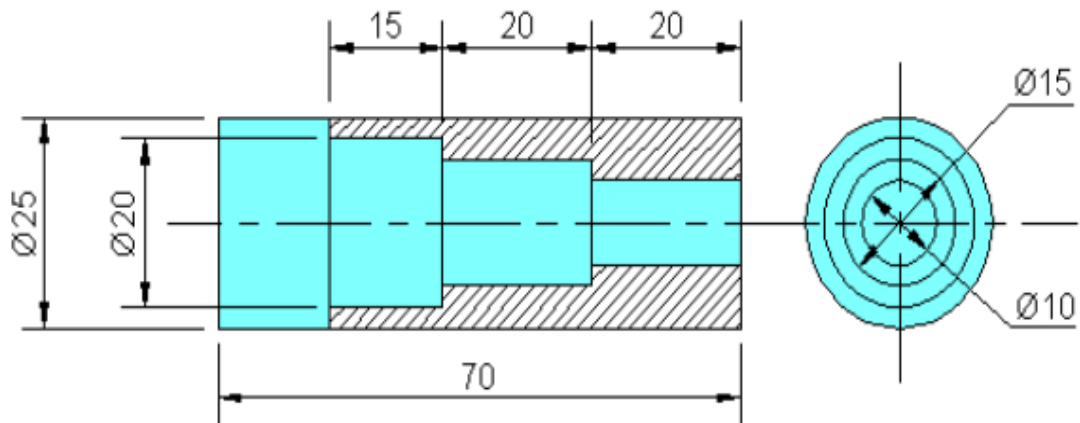
<b>O2100</b>	Name/Program Number
<b>G21 G98</b>	Metric system, Feed Rate per minute
<b>G28 U0 W0</b>	Automatic Reference Point return (MACHINE ZERO), Incremental Programming
<b>M06 T0101</b>	Tool Change (Tool no 1 offset of 1)
<b>M03 S2000 M08</b>	Spindle rotation Clockwise, Spindle speed 2000, Coolant ON
<b>G00 X28 Z5</b>	Rapid Movement to point (28,5)
<b>G00 X23 Z1</b>	Rapid Movement to the point (23,1)
<b>G01 Z-50 F45</b>	Liner Interpolation from (23,1) to (23,-50), feed 45mm /min (Turning Process)
<b>G01 X 27</b>	Liner Interpolation from (23,-50) to (27,-50), feed 45mm /min (Turning Process)
<b>G00 Z3</b>	Rapid Movement to the point (27,3)
<b>G00 X21</b>	Rapid Movement to the point (21,3)
<b>G01 Z-50 F45</b>	Liner Interpolation from (21,1) to (21,-50), feed 45mm /min (Turning Process)
<b>G01 X27</b>	Liner Interpolation from (21,-50) to (27,-50), feed 45mm /min (Turning Process)
<b>G00 Z3</b>	Rapid Movement to the point (27,3)
<b>G00 X19</b>	Rapid Movement to the point (19,3)
<b>G01 Z-50 F45</b>	Liner Interpolation from (19,3) to (19,-50), feed 45mm /min (Turning Process)

<b>G01 X27</b>	Liner Interpolation from (19,-50) to (27,-50), feed 45mm /min (Turning Process)
<b>G00 Z3</b>	Rapid Movement to the point (27,3)
<b>G00 X17</b>	Rapid Movement to the point (17,3)
<b>G01 Z-25 F45</b>	Liner Interpolation from (17,3) to (17,-25), feed 45mm /min (Turning Process)
<b>G01 X27</b>	Liner Interpolation from (17,-25) to (27,-25), feed 45mm /min (Turning Process)
<b>G00 Z3</b>	Rapid Movement to the point (27,3)
<b>G00 X15</b>	Rapid Movement to the point (15,3)
<b>G01 Z-25 F45</b>	Liner Interpolation from (15,3) to (15,-25), feed 45mm /min (Turning Process)
<b>G01 X27</b>	Liner Interpolation from (15,-25) to (27,-25), feed 45mm /min (Turning Process)
<b>G00 Z3</b>	Rapid Movement to the point (27,3)
<b>G00 X13</b>	Rapid Movement to the point (13,3)
<b>G01 Z-25 F45</b>	Liner Interpolation from (13,3) to (13,-25), feed 45mm /min (Turning Process)
<b>G01 X27 Z5 M09</b>	Liner Interpolation from (13,-25) to (27,-25), feed 45mm /min (Turning Process), Coolant OFF
<b>G28 U0 W0</b>	Automatic Reference Point return (MACHINE ZERO)
<b>M05</b>	Spindle Stop
<b>M30</b>	Program Stop and Rewind



### Practical No 1:

Write a manual part programming for the given step turning on the part of size 70mmX25mm



All Dimensions are in mm

#### Absolute Programming:

```
G21 G98
G28 U0 W0
M06 T0101
M03 S2000
G00 X27 Z5 M08
G01 X25 Z5 F45
G01 X22 Z-55 F45
G01 X27 F45
G00 Z5
G00 X20 Z5
G01 X20 Z-55 F45
G01 X27 F45
G00 Z5
G00 X17 Z5
G01 X17 Z-40 F45
G01 X27 F45
G00 Z5
G00 X15
G01 X15 Z-40 F45
G01 X27 F45
G00 Z5
G00 X12
G01 X12 Z-20 F45
G01 X27 F45
G00 Z5
G00 X10
G01 X10 Z-20 F45
G01 X27 F45
G28 U0 W0
M09
```

M05  
M30

### **Incremental Programming**

G21 G98  
G28 U0 W0  
M06 T0101  
M03 S2000  
M08  
G00 X27 Z5  
G91 G00 X-7  
G01 Z-60 F45  
G01 X7 F45  
G00 Z60  
G00 X-12  
G01 Z-45 F45  
G01 X12 F45  
G00 Z45  
G00 X-17  
G01 Z-25 F45  
G01 X17  
G28 U0 W0  
M09  
M05  
M30

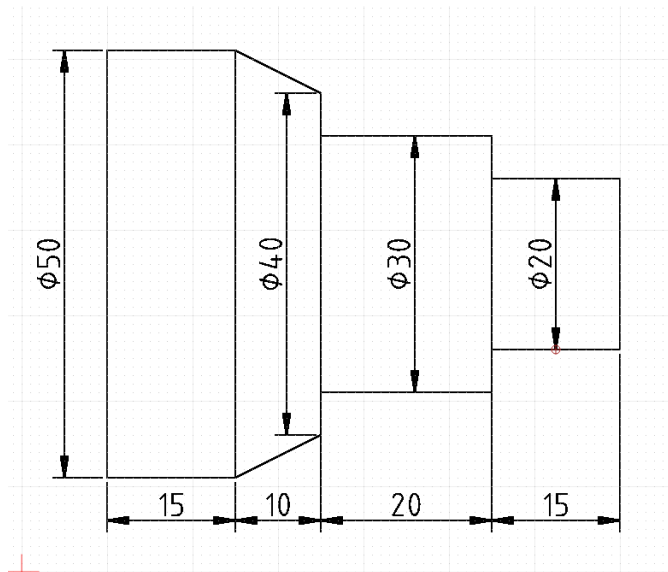
(No minimum depth of cut assumed, Cutting is done along the profile)



```
G21 G98
G28 U0 W0
M06 T0101
M03 S2000
G00 X27 Z5 M08
G01 X25 Z5 F45
G01 X22 Z-55 F45
G01 X27 F45
G00 Z5
G00 X20 Z5
G01 X20 Z-55 F45
G01 X27 F45
G00 Z5
G00 X17 Z5
G01 X17 Z-40 F45
G01 X27 F45
G00 Z5
G00 X15
G01 X15 Z-40 F45
G01 X27 F45
G00 Z5
G00 X12
G01 X12 Z-20 F45
G01 X27 F45
G00 Z5
G00 X10
G01 X10 Z-20 F45
G01 X27 F45
G28 U0 W0
M09
M05
M30
```

## PRACTICAL 2:

Write a manual part program for taper turning on the given billet 60mm X 50 mm



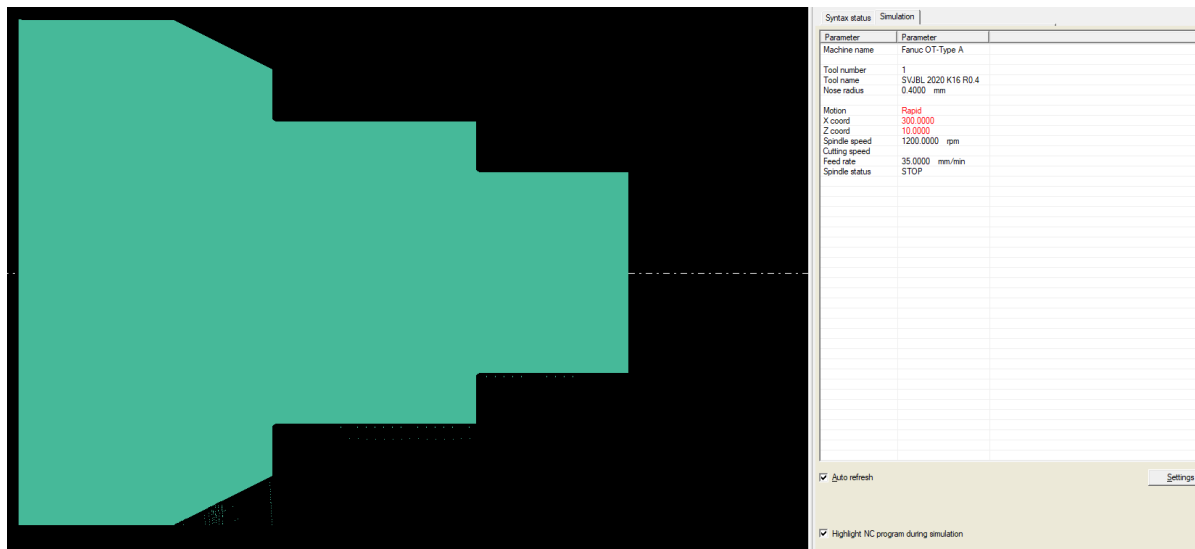
### Absolute System:

```
G21 G98
G28 U0 W0
M06 T0101
M03 S1200 M08
G00 X46 Z5
G01 Z-35 F35
G01 X52 F35
G00 Z5
G00 X42
G01 X42 Z-35 F35
G01 X52 F35
G00 Z5
G00 X38
G01 X38 Z-35 F35
G01 X52 F35
G00 Z5
G00 X34
G01 X34 Z- 35 F35
G01 X52 F35
G00 Z5
G00 X30
G01 X30 Z- 35 F35
G01 X52 F35
G00 Z5
G00 X26
G00 X26 Z-15 F35
G01 X32 F35
G00 Z5
G00 X22
G01 X22 Z-15 F35
G01 X32 F35
```

```
G00 Z5
G00 X20
G01 X20 Z-15 F35
G01 X40 F35
G01 X40 Z-35 F35
G01 X50 Z-45 F35
G01 X50 Z-60
G28 U0 W0
M09
M05
M30
```

## **INCREMENTAL SYSTEM**

G21 G98  
G28 U0 W0  
M06 T0101  
M03 S1200 M08  
G00 X40 Z5  
G91 G01 Z-40 F45  
G01 X12  
G00 Z45  
G00 X-22  
G01 Z-40 F45  
G01 X12  
G00 Z45  
G00 X-32  
G01 Z-20 F45  
G01 X20 F45  
G01 Z-20 F45  
G01 X10 Z-10 F45  
G01 Z-15  
G28 U0 W0  
M05  
M30



```

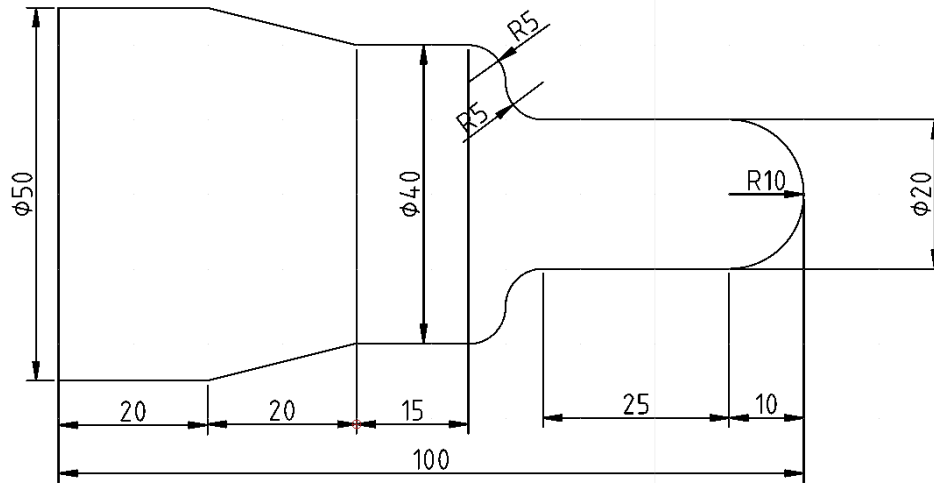
G21 G98
G28 U0 W0
M06 T0101
M03 S1200 M08
G00 X46 Z5
G01 Z-35 F35
G01 X52 F35
G00 Z5
G00 X42
G01 X42 Z-35 F35
G01 X52 F35
G00 Z5
G00 X38
G01 X38 Z-35 F35
G01 X52 F35
G00 Z5
G00 X34
G01 X34 Z-35 F35
G01 X52 F35
G00 Z5
G00 X30
G01 X30 Z-35 F35
G01 X52 F35
G00 Z5
G00 X26
G00 X26 Z-15 F35
G01 X26 F35
G00 Z5
G00 X22
G01 X22 Z-15 F35
G01 X32 F35
G00 Z5
G00 X20
G01 X20 Z-15 F35
G01 X40 F35
G01 X40 Z-35 F35
G01 X50 Z-45 F35
G01 X50 Z-60
G28 U0 W0
M09
M05
M30

```



### PRACTICAL 3:

Write a manual part program for making circular interpolation on the part of size 100X50 mm



Absolute Programming:

```
N10 G21
N20 G28 U0 W0
N30 M06 T0101
N40 M03 S1200
N50 G00 X55 Z1 M08
N60 G71 U2 W1
N70 G71 P80 Q150 U1 W0.2 F0.26
N80 G01X0 Z0 F0.26
N90 G03 X20 Z-10 R10 F0.26
N100 G01 Z-35 F0.26
N110 G02 X30 Z-40 R5 F0.26
N120 G03 X40 Z-45 R5 F0.26
N130 G01 X40 Z-60 F0.26
N140 G01 X50 Z-80 F0.26
N150 G01 X50 Z-100 F0.26
N160 G28 U0 W0
N170 M06 T0202 F2.0
N180 G70 P80 Q150
N190
G28 U0 W0
M09
M05
M30
```



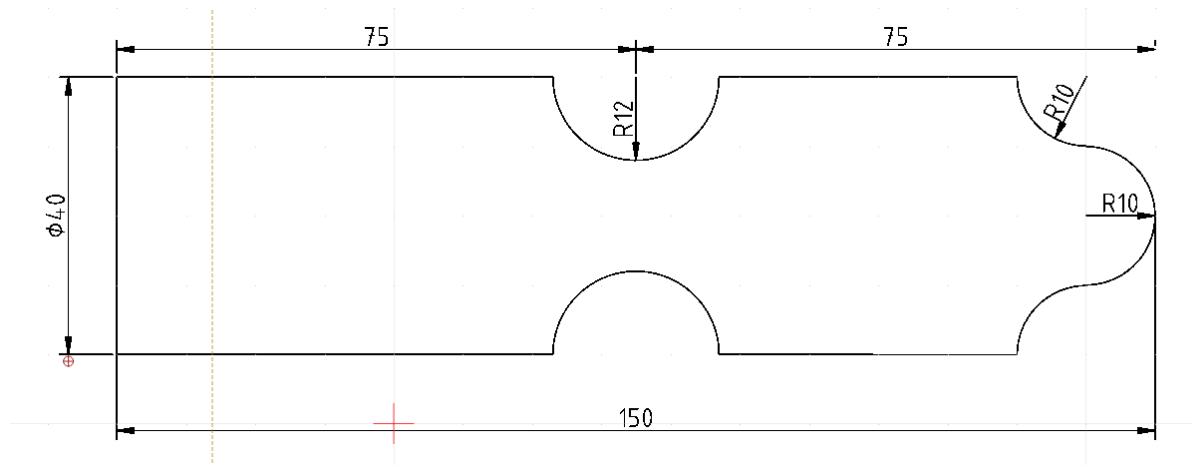
```

N10 G21
N20 G28 U0 W0
N30 M06 T0101
N40 M03 S1200
N50 G00 X55 Z1 M08
N60 G71 U2 W1
N70 G71 P80 Q150 U1 W0.2 F0.26
N80 G01X0 Z0 F0.26
N90 G03 X20 Z-10 R10 F0.26
N100 G01 Z-35 F0.26
N110 G02 X30 Z-40 R5 F0.26
N120 G03 X40 Z-45 R5 F0.26
N130 G01 X40 Z-60 F0.26
N140 G01 X50 Z-80 F0.26
N150 G01 X50 Z-100 F0.26
N160 G28 U0 W0
N170 M06 T0202 F2.0
N180 G70 P80 Q150
N190
G28 U0 W0
M09
M05
M30

```

# PRACTICAL NO 4:

Write a manual part program for the profile shown in the diagram on a billet of size 150 x 40



## **Absolute Programming:**

```
G21 G98
G28 U0 W0
M06 T0101
M03 S1200
G00 X42 Z5 M08
G01 X0 Z0 F50
G03 X20 Z-10 R10 F50
G02 X40 Z-20 R10 F50
G01 X40 Z-63 F50
G28 U0 W0
M06 T0202
G00 X42 Z-63
G01 X40 Z-63 F50
G02 X40 Z-87 R12 F50
G01 X40 Z-150 F50
G28 U0 W0
M09
M05
M30
```

## **Incremental programming**

```
G21 G98
G28 U0 W0
M06 T0101
M03 S1200
G00 X42 Z5 M08
G01 X0 Z0 F50
G91 G03 X20 Z-10 R10 F50
G02 X20 Z-10 R10 F50
G01 Z-33 F50
G28 U0 W0
M06 T0202
G90 G00 X42 Z-63
G01 X40 Z-63 F50
G91 G02 Z-24 R12 F50
G01 Z-63
G28 U0 W0
M05
M30
```



```
G21 G98
G28 U0 W0
M06 T0101
M03 S1200
G00 X42 Z5 M08
G01 X0 Z0 F50
G03 X20 Z-10 R10 F50
G02 X40 Z-20 R10F50
G01 X40 Z-63 F50
G28 U0 W0
M06 T0202
G00 X42 Z-63
G01 X40 Z-63 F50
G02 X40 Z-87 R12 F50
G01 X40 Z-150 F50
G28 U0 W0
M09
M05
M30
```

### Practical no 5:

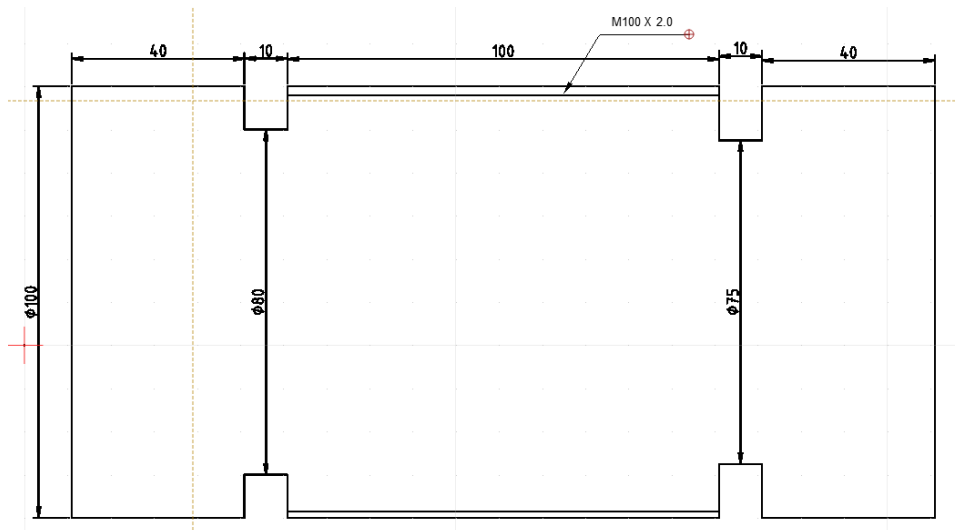
Write a manual part program for the part shown below

Given: Billet Size : 200x100, Thread : M100X2.0

#### Calculation of Minor Diameter

Depth =  $0.631 \times \text{pitch} = 0.631 \times 2.0 = 1.26 \text{ mm}$

Minor Diameter = Outer Diameter – Depth =  $100 \text{ mm} - 1.26 \text{ mm} = 98.74 \text{ mm}$



```
G21 G98
G28 U0 W0
M06 T0101
M03 S1200
G00 X102 Z-43
G75 R500 ( Grooving Cycle)
G75 X75 Z-50 P500 Q2500 R0.0 F0.26
G00 X106 Z-153
G00 X103 Z-153
G75 R500 ( Grooving Cycle)
G75 X80 Z-160 P500 Q2500 R0.0 F0.26
G00 X106 Z5
M06 T0303
G00 X100 Z-50
G76 P020060 Q200 R100 ( Threading Cycle)
G76 X98.74 Z-150 R0.0 P1260 Q200 F2.5
G00 X106 Z5
G40
G28 U0 W0
M05
M30
```



```
G21 G98
G28 U0 W0
M06 T0101
M03 S1200
G00 X102 Z-43
G75 R500
G75 X75 Z-50 P500 Q2500 R0.0 F0.26
G00 X106 Z-153
G00 X103 Z-153
G75 R500
G75 X80 Z-160 P500 Q2500 R0.0 F0.26
G00 X106 Z5
M06 T0303
G00 X100 Z-50
G76 P020060 Q200 R100
G76 X98.74 Z-150 R0.0 P1260 Q200 F2.5
G00 X106 Z5
G40
G28 U0 W0
M05
M30
```

**Practical No 6. Write a manual part program for the part shown below (Refer your Notebook for Diagram)**

Given:

Billet Size : 150x40

Thread : M30X3

Turning Tool: T0101 (SVJBL 2020 K16 R0.4)

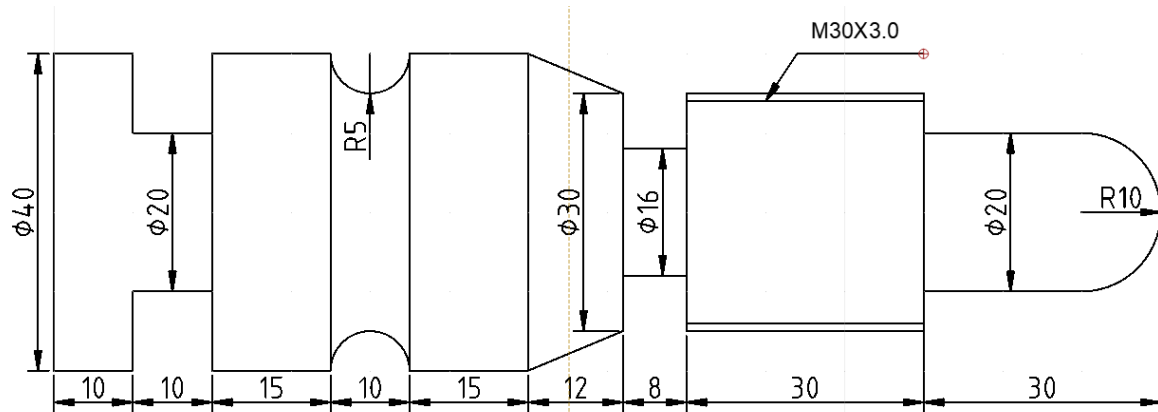
Grooving Tool: T0202 (25X25, 3.1 W, 16 depth LH)

Threading Tool: T0303 (Thread 16x16, 60, Depth 3.0 LH)

**Calculation of Minor Diameter**

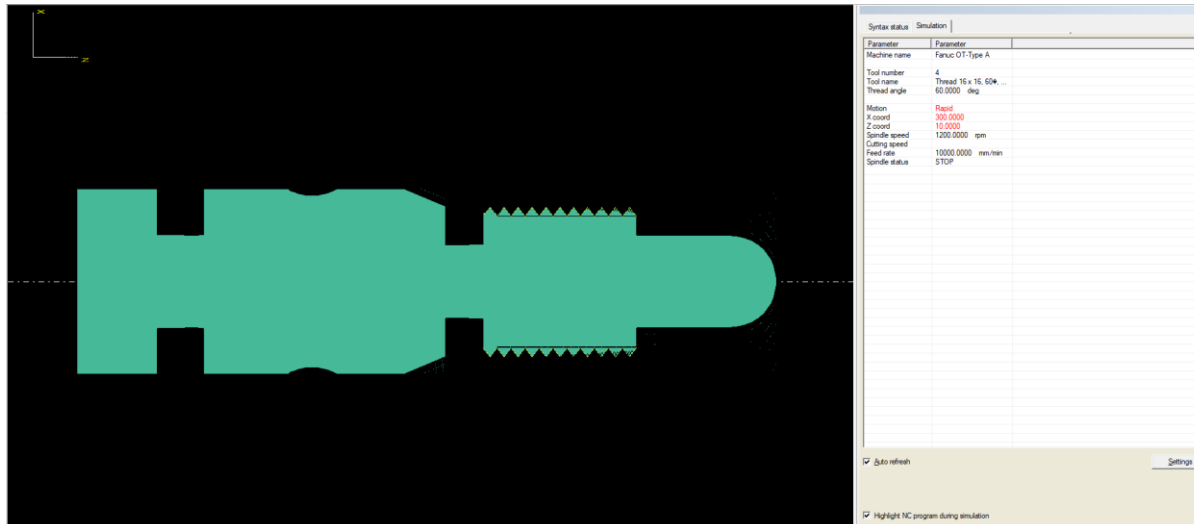
Depth =  $0.631 \times \text{pitch} = 0.631 \times 3.0 = 1.89 \text{ mm}$

Minor Diameter = Outer Diameter – Depth =  $30 \text{ mm} - 1.89 \text{ mm} = 28.107 \text{ mm}$



G21 G40  
 G28 U0 W0  
 M06 T0101  
 M03 S1200  
 G00 X45 Z0  
 G01 X0 Z0 F0.3  
 G03 X20 Z-10 R10 F0.3  
 G01 X20 Z-30 F0.3  
 G01 X30 Z-30 F0.3  
 G01 X30 Z-60 F0.3  
 G01 X30 Z-68 F0.3  
 G01 X40 Z-80 F0.3  
 G01 X40 Z-95 F0.3  
 G02 X40 Z-105 R10 F0.3  
 G01 X40 Z-150 F0.3  
 M06 T0202  
 G00 X40 Z-120  
 G01 X40 Z-123 F0.3

G75 R1.0  
 G75 X20 Z-130 P400 Q1000 F2.0  
 G01 X45 F0.3  
 G00 X45 Z-63  
 G75 R0.1  
 G75 X16 Z-68 P400 Q1000 F2.0  
 G01 X45 F0.3  
 G28 U0 W0  
 M06 T0303  
 G00 X33 Z-30  
 G01 X30 Z-30 F0.3  
 G76 P020060 Q200 R100  
 G76 X28.107 Z-60 R0.0 P1890 Q200 F3.0  
 G01 X45 F2.0  
 G28 U0 W0  
 M05  
**M30**



```

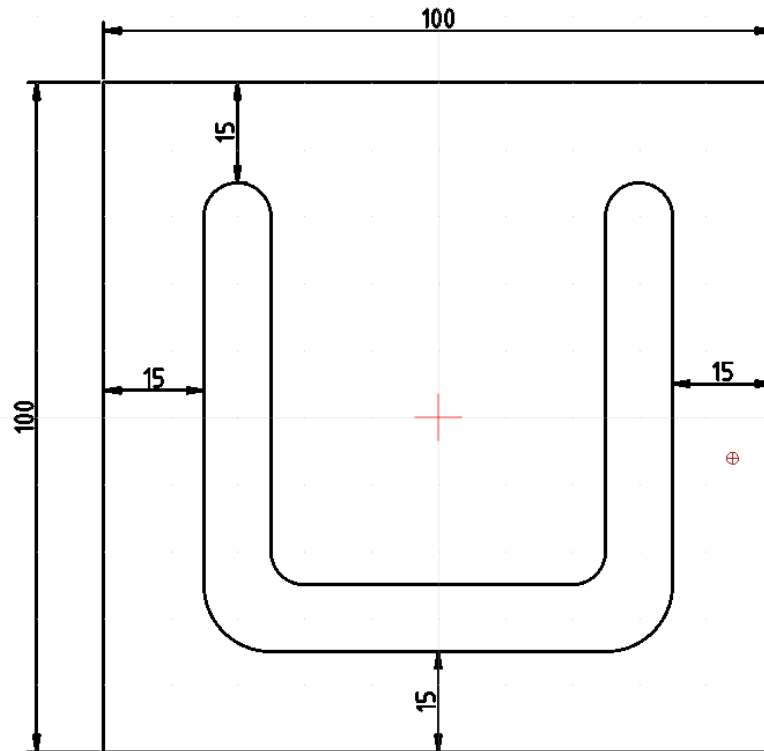
G21 G40
G28 U0 W0
M06 T0101
M03 S1200
G00 X45 Z0
G01 X0 Z0 F0.3
G03 X20 Z-10 R10 F0.3
G01 X20 Z-30 F0.3
G01 X30 Z-30 F0.3
G01 X30 Z-60 F0.3
G01 X30 Z-68 F0.3
G01 X40 Z-80 F0.3
G01 X40 Z-95 F0.3
G02 X40 Z-105 R10 F0.3
G01 X40 Z-150 F0.3
M06 T0202
G00 X40 Z-120
G01 X40 Z-123 F0.3
G75 R1.0
G75 X20 Z-130 P400 Q1000 F2.0
G01 X45 F0.3
G00 X45 Z-63
G75 R0.1
G75 X16 Z-68 P400 Q1000 F2.0
G01 X45 F0.3
G28 U0 W0
M06 T0303
G00 X33 Z-30
G01 X30 Z-30 F0.3
G76 P020060 Q200 R100
G76 X28.107 Z-60 R0.0 P1890 Q200 F3.0
G01 X45 F2.0
G28 U0 W0
M05
M30

```



### Practical No: 7

Develop a part program for slot milling and simulate for the Blank size of 100x100x20.  
Pocket depth = 10mm

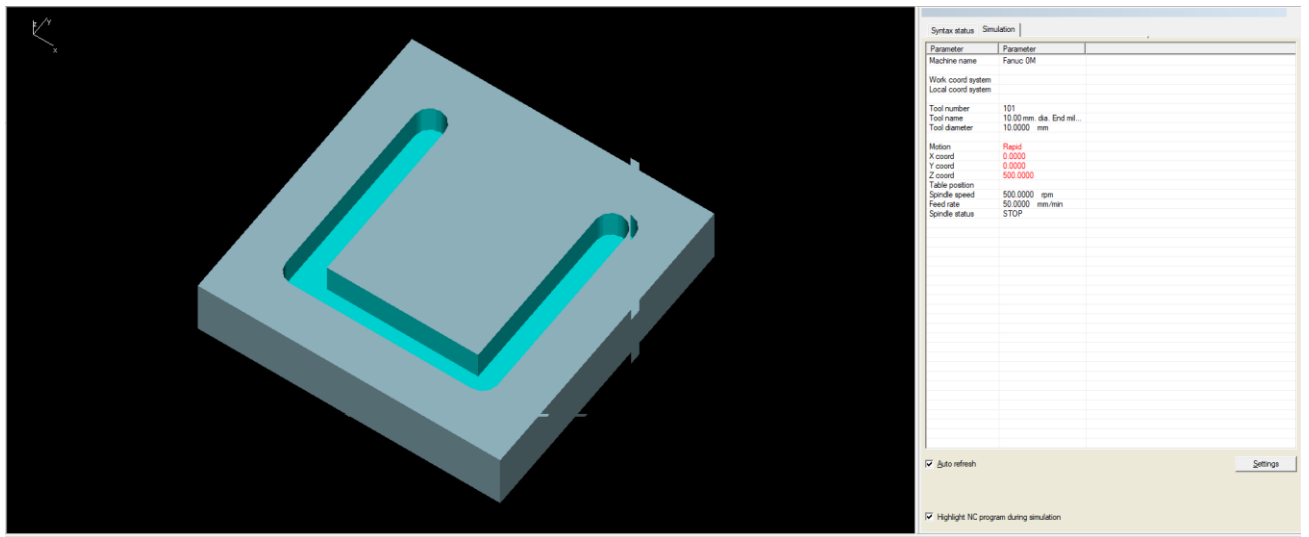


#### Part Program in Absolute Mode:

```
G21 G98
G28 X0 Y0 Z0
M06 T0101
M03 S500
G00 X0 Y0 Z5
G90 G01 X20 Y80 Z5 F50
G01 X20 Y80 Z-10 F50
G01 X20 Y20 Z-10 F50
G01 X80 Y20 Z-10 F50
G01 X80 Y80 Z-10 F50
G01 X80 Y80 Z5
G28
M05
M30
```

#### Part Program in Incremental Mode:

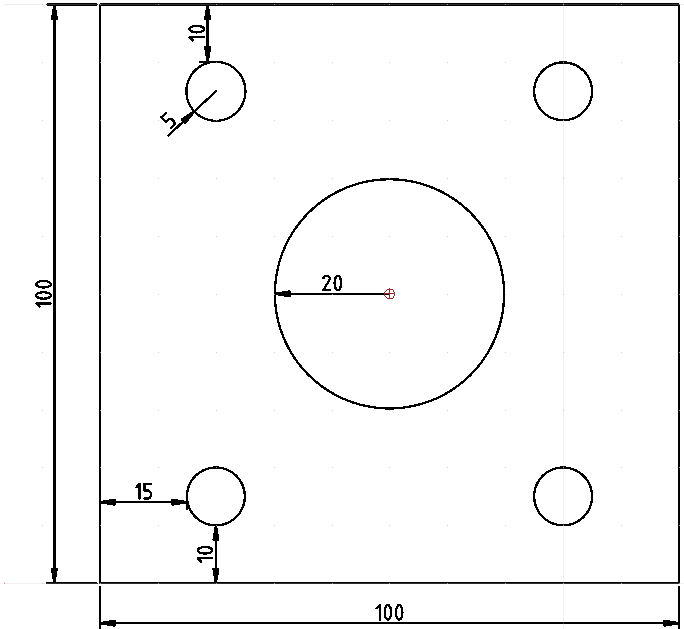
```
G21 G98
G28 X0 Y0 Z0
M06 T0101
M03 S500
G00 X0 Y0 Z5
G91 G01 X20 Y80 Z5 F50
G01 Z-15 F50
G01 Y-60 F50
G01 X60 F50
G01 Y60 F50
G01 Z15 F50
G28
M05
M30
```

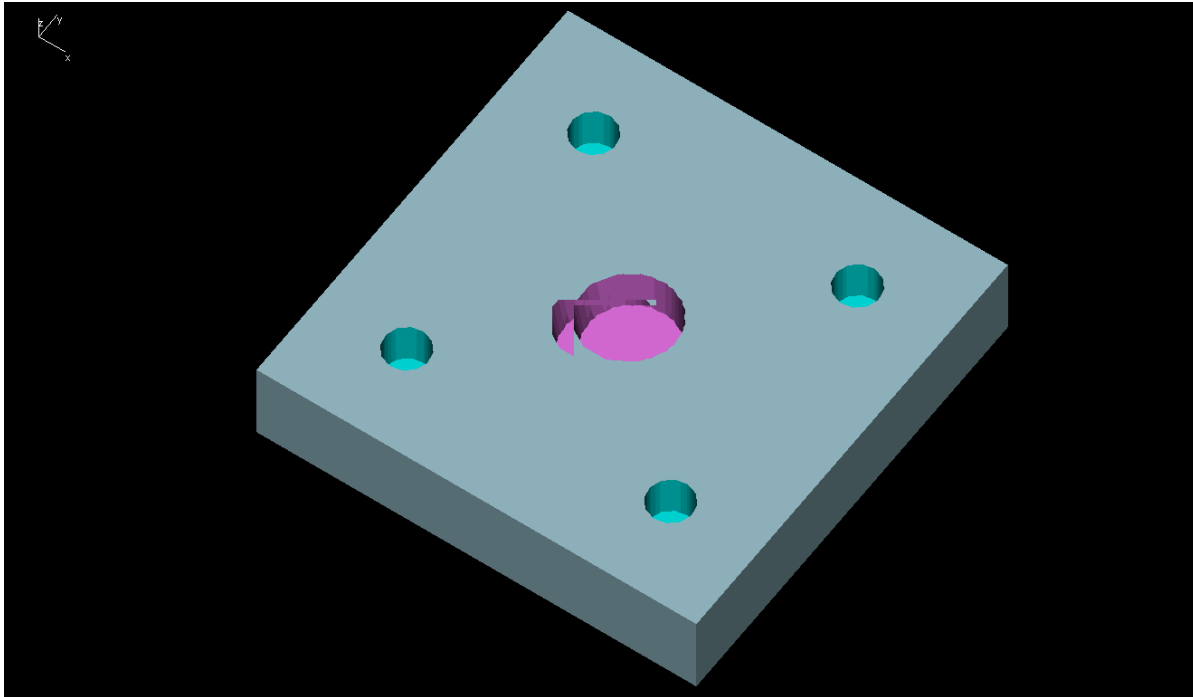


```
G21 G98
G28 X0 Y0 Z0
M06 T0101
M03 S500
G00 X0 Y0 Z5
G90 G01 X20 Y80 Z5 F50
G01 X20 Y80 Z-10 F50
G01 X20 Y20 Z-10 F50
G01 X80 Y20 Z-10 F50
G01 X80 Y80 Z-10 F50
G01 X80 Y80 Z5
G28
M05
M30
```

### Practical No: 8

Develop a part program e for the Blank size of 100x100x20. Pocket depth = 10mm. Use Drilling Cycle to achieve the shape.

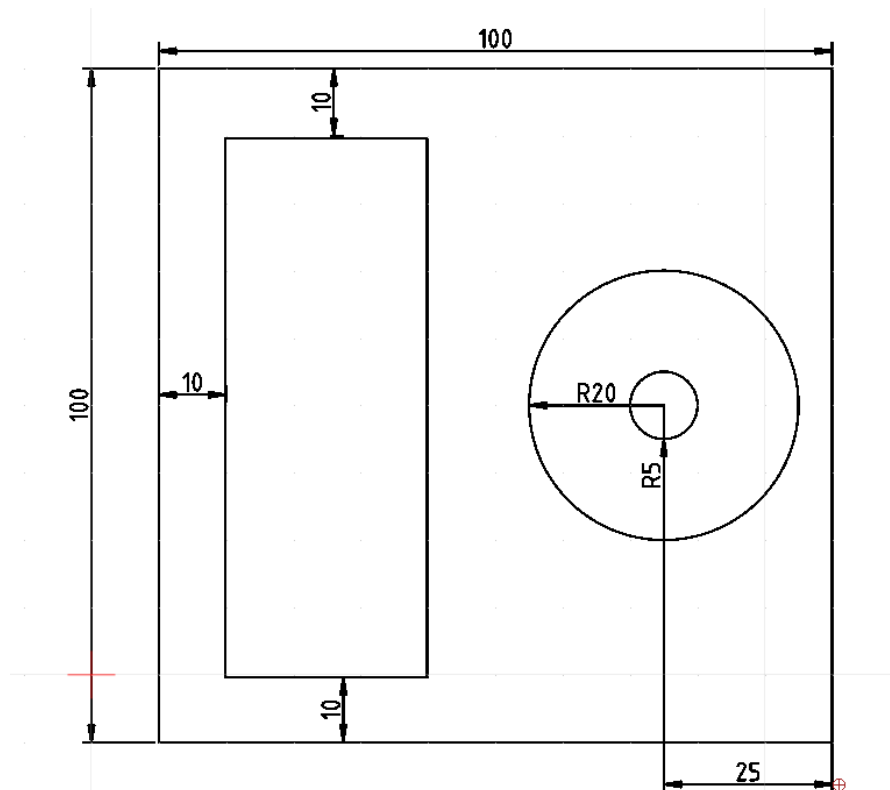
	
<b>Absolute Method:</b> G21 G98 G43 G28 X0 Y0 Z0 M06 T01 M03 S500 M08 G90 G00 X0 Y0 Z20 X20 Y80 G98 G81 Z-10 R5 F100 X20 Y20 X80 Y20 X80 Y80 G80 G28 M06 T02 G01 X50 Y50 Z-10 F100 G01 Z20 G28 M09 M05 M30	<b>Incremental method</b> G21 G98 G43 G28 X0 Y0 Z0 M06 T01 M03 S500 M08 G90 G00 X0 Y0 Z20 G91 X20 Y80 G98 G81 Z-15 R5 Y-60 X60 G80 G28 M06 T02 X-30 Y-30 G80 G00 Z30 G28 M06 M30



```
G21 G98 G43
G28 X0 Y0 Z0
M06 T01
M03 S500 M08
G90 G00 X0 Y0 Z20
X20 Y80
G98 G81 Z-10 R5 F100
X20 Y20
X80 Y20
X80 Y80
G80
G28
M06 T02
G01 X50 Y50 Z-10 F100
G01 Z20
G28
M09
M05
M30
```

### Practical No 9:

Develop a part program for rectangular and Circular Pocketing and Simulate the blank size 100x100x20. Pocket Depth = 10 mm.



#### Absolute method:

```
G21
G28
M06 T01 G43
M03 S1200
M08
G90 G00 X0 Y0 Z5
G01 X15 Y15 F50
G01 Z-10
X15 Y85
X20 Y85
X20 Y15
X25 Y15
X25 Y85
X30 Y85
X30 Y15
X35 Y15
X35 Y85
X15 Y85
X15 Y15
X35 Y15
X35 Y85
Z00
G00 X75 Y40
G01 X75 Y40 Z-10
```

```
G03 X75 Y60 R10
G03 X75 Y40 R10
G01 X75 Y35
G03 X75 Y65 R15
G03 X75 Y35 R15
G00 Z20
G28
M09
M05 M30
```

**Incremental Method:**

G21

G28

M06 T01 G43

M03 S1200

M08

G90 G00 X0 Y0 Z5

G91 G01 X15 Y15 F50

G01 Z-15 F50

G01 Y70 F50

G01 X10 F50

G01 Y-70 F50

G01 X10 F50

G01 Y70 F50

G01 X-20 F50

G01 Y-70 F50

G01 X20 F50

G01 Y70 F50

G01 Z15 F50

G28

G90 G00 X65 Y50 Z5

G91 G01 Z-15 F35

G02 X0 Y0 I10 J0 F35

G01 X-5 F35

G02 X0 Y0 I15 J0 F35

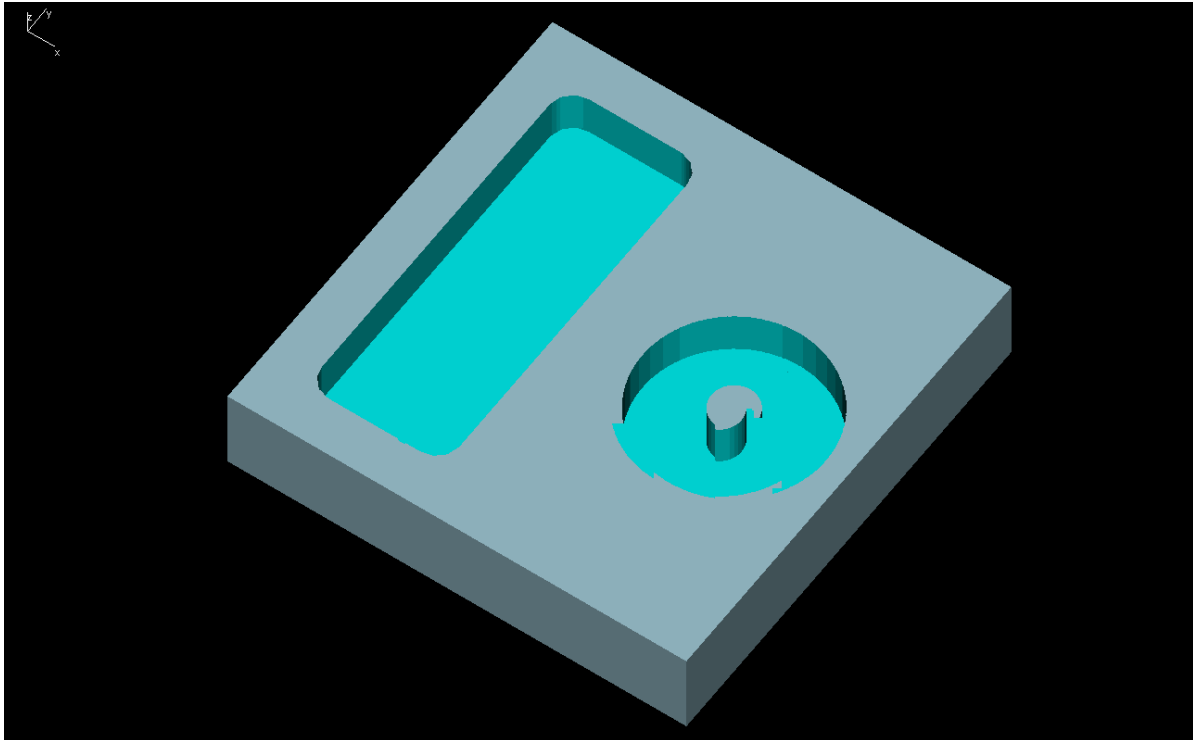
G01 Z15

G28

M05

**M30**

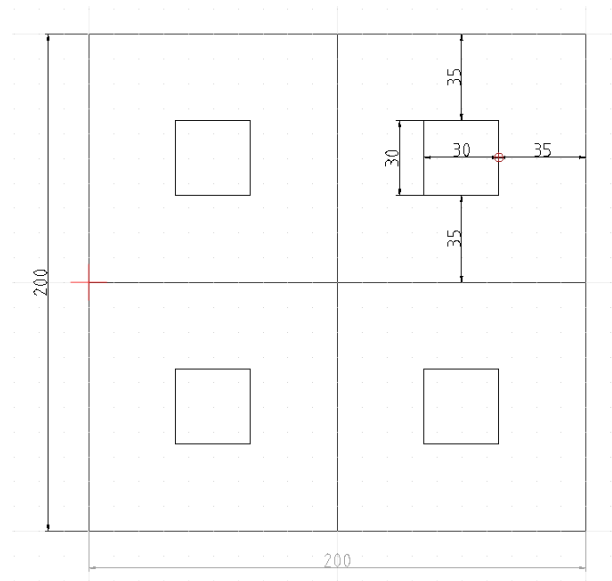
(Modify the cutter tool diameter to 10.5mm to avoid  
backlashes)



```
G21
G28
M06 T01 G43
M03 S1200
M08
G90 G00 X0 Y0 Z5
G01 X15 Y15 F50
G01 Z-10
X15 Y85
X20 Y85
X20 Y15
X25 Y15
X25 Y85
X30 Y85
X30 Y15
X35 Y15
X35 Y85
X15 Y85
X15 Y15
X35 Y15
X35 Y85
Z00
G00 X75 Y40
G01 X75 Y40 Z-10
G03 X75 Y60 R10
G03 X75 Y40 R10
G01 X75 Y35
G03 X75 Y65 R15
G03 X75 Y35 R15
G00 Z20
G28
M09
M05 M30
```

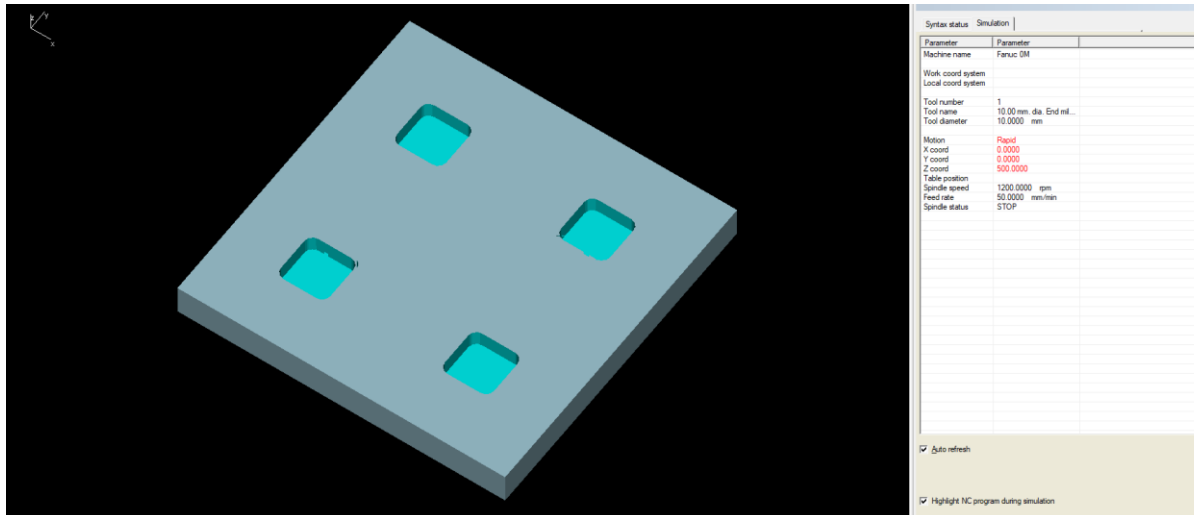
## Practical No 10:

Write a manual part program for mirroring the square pattern using subroutines. Simulate for the blank size 200x200x20



```
G21 G28
M06 T01
M03 S1200 F50
G90 G00 X0 Y0 Z5
M98 P20
M70
M98 P20
M71
M98 P20
M80
M98 P20
M81
M05
G90 G00 Z50
G28
M09
M30
O20
G00 X50 Y50
G01 X50 Y50 Z-10
X55 Y50
X55 Y55
X45 Y55
X45 Y45
X55 Y50
X60 Y50
X60 Y60
X40 Y60
X40 Y40
X60 Y40
X60 Y50
Z20
G00 X0 Y0
M99
```





```

G21 G28
M06 T01
M03 S1200 F50
G90 G00 X0 Y0 Z5
M98 P20
M70
M98 P20
M71
M98 P20
M80
M98 P20
M81
M05
G90 G00 Z50
G28
M09
M30
O20
G00 X50 Y50
G01 X50 Y50 Z-10
X55 Y50
X55 Y55
X45 Y55
X45 Y45
X55 Y50
X60 Y50
X60 Y60
X40 Y60
X40 Y40
X60 Y40
X60 Y50
Z20
G00 X0 Y0
M99

```