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UNIT : COMPUTER CONTROLLED

MANUFACTURING

UNIT CODE : EMT 2503

TASK : CAT 1 & 2

Date : 13/08/2021

QUESTION

You are required to cut out a profile of the TWO initials of your Name from an Aluminum plate 5mm thick. The plate's length and width are 30cm by 30cm respectively. The cutting tool is an end mill of diameter 5 mm, with two cutting edges. Due to the directionality of the stiffness of the machine structure, it is desired that the feed rate should not exceed 0.25 mm/tooth while machining the curved surface, and 0.4mm/tooth while machining the straight surface. The cutting speed for the material should be 80 m/min.

A) Calculate the spindle speed required.

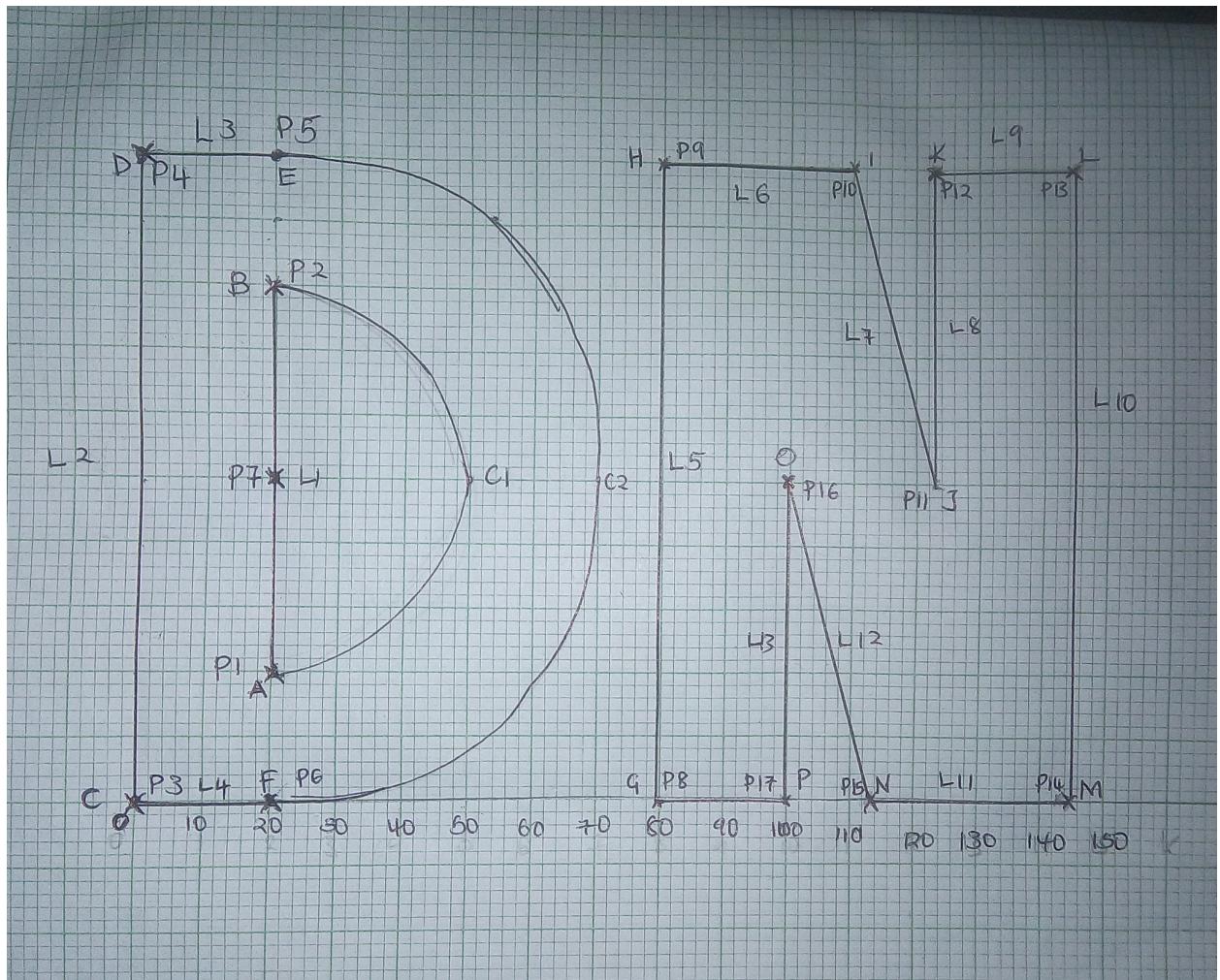
$$n = \frac{Vc * 1000}{\pi * Dm}$$

$$n = \frac{80m/min * 1000}{\pi * 5mm}$$

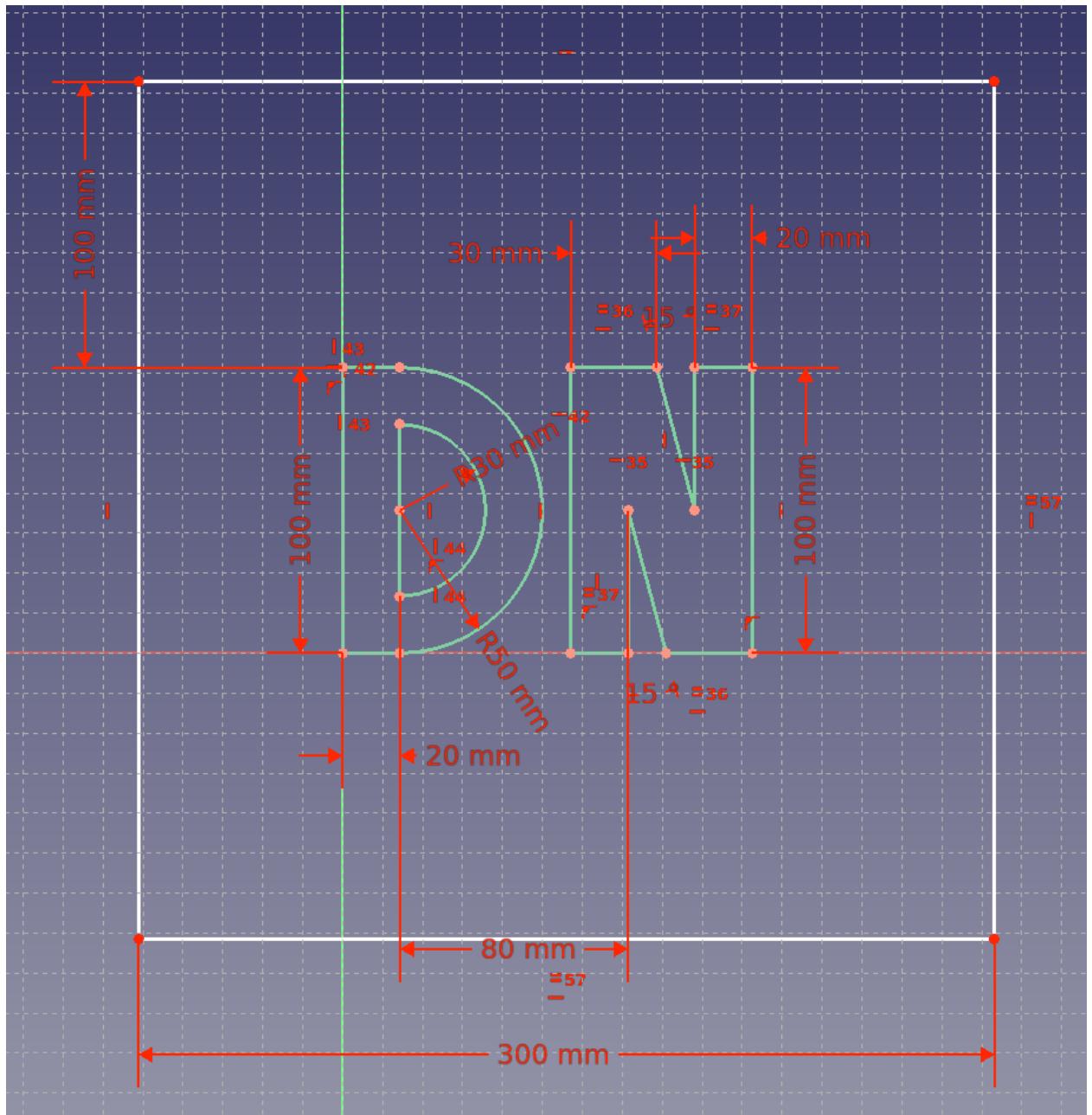
$$n = 5092.95 \text{ rev/min} \approx 5093 \text{ rev/min}$$

B) Design and sketch the profile of the initials on a graph paper

Graph sketch



Freecad drawing

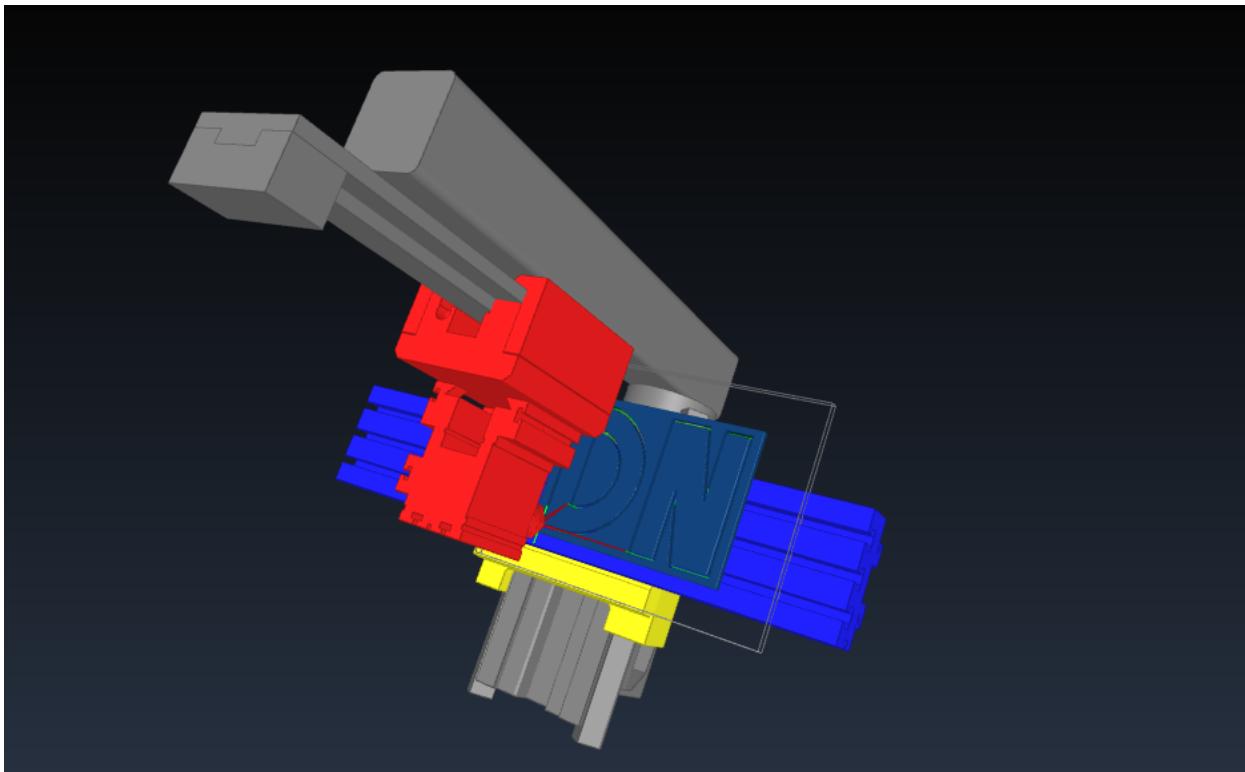
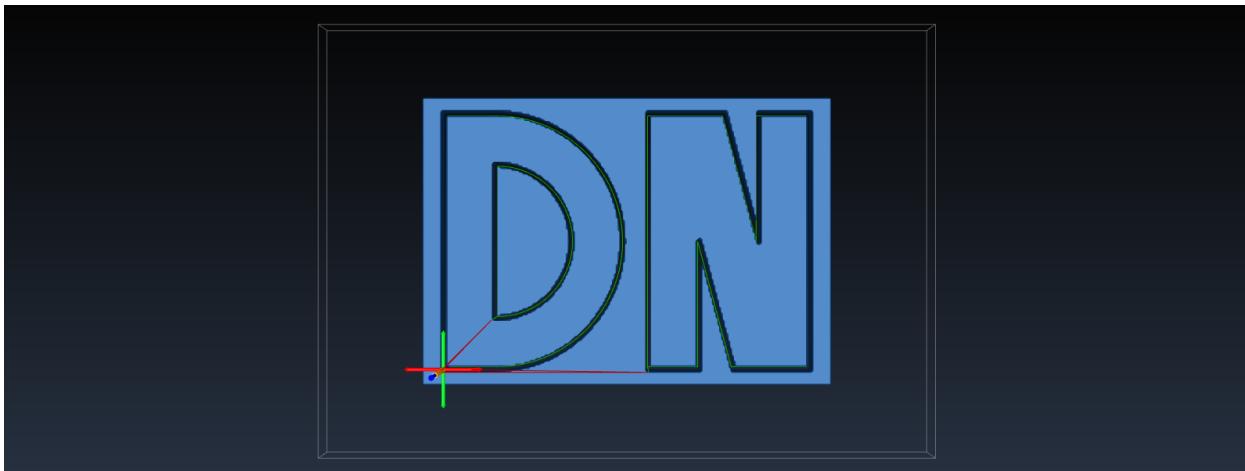


C) Write a numerical control code for the profile generation.

```
G21 G17 G90
M03 S5093 F100 T01 D05 ;
G41 ; Cutter compensation left
M08 ; Turn coolant on
G00 X20 Y20 Z5 ; Starting point for inner D
G01 Z-5 ;drill into wp
G01 X20 Y80
G02 X20 Y20 I0 J-30;
G01 Z5 ;Raise the tool
G00 X0 Y0 ; Starting point for outer D
G01 Z-5 ; Drill into wp
G01 X0 Y100
G01 X20 Y100
G02 X20 Y0 I0 J-50;
G01 X0 Y0
G01 Z5 ; Raise tool
G00 X80 Y0 ; Starting point for N
G01 Z-5 ; Drill into wp
G01 X80 Y100
G01 X110 Y100
G01 X123.4 Y50
G01 X123.4 Y100
G01 X143.4 Y100
G01 X143.4 Y0
G01 X113.4 Y0
G01 X100 Y50
G01 X100 Y0
G01 X80 Y0
G01 Z5 ; Raise tool
```

```
M09 ; Coolant off  
G40 G28 M05 ; Cutter compensation cancel,zero  
return,spindle stop  
M30 ; program end
```

G Code simulation



D)Write an APT code for the profile generation.

```
PARTNO My Initials Profile
UNITS/MM
CUTTER/5
PTARG = POINT/0,0,5
REMARK Points on the letter D
P1 = POINT/20,20,-5
P2 = POINT/20,80,-5
P3 = POINT/0,0,-5
P4 = POINT/0,100,-5
P5 = POINT/20,100,-5
P6 = POINT/20,0,-5
P7 = POINT/20,0,-5
REMARK Points on the letter N
P8 = POINT/80,0,-5
P9 = POINT/80,100,-5
P10 = POINT/110,100,-5
P11 = POINT/123.4,50,-5
P12 = POINT/123.4,100,-5
P13 = POINT/143.4,100,-5
P14 = POINT/143.4,0,-5
P15 = POINT/113.4,0,-5
P16 = POINT/100,50,-5
P17 = POINT/100,0,-5

L1 = LINE/P1,P2
C1 = CIRCLE/CENTER,P7,RADIUS,30
L2 = LINE/P3,P4
L3 = LINE/P4,P5
C2 = CIRCLE/CENTER,P7,RADIUS,50
L4 = LINE/P6,P3
L5 = LINE/P8,P9
L6 = LINE/P9,P10
L7 = LINE/P10,P11
L8 = LINE/P11,P12
L9 = LINE/P12,P13
L10 = LINE/P13,P14
L11 = LINE/P14,P15
L12 = LINE/P15,P16
```

```
L13 = LINE/P16,P17
L14 = LINE/P17,P8
PL1 = PLANE/P3,P11,P14
REMARK Start cutter motion statements
FROM/PTARG
LOADTL/01
SPINDL/5093,CLW
FEDRAT/50,IPM
COOLNT/FLOOD
REMARK cutter motion for letter D
GO/TO,L1,TANTO,C1
GOLFT/C1,TO,L1
GO/TO,L2,PAST,L3
GORIGHT/L3,TANTO,C2
GOFWD/C2,PAST,L4
REMARK cutter motion for letter D
RAPID
GOTO/PTARG
SPINDL/OFF
COOLNT/OFF
LOADTL/01
RAPID
FROM/PTARG
GOTO/P5
COOLNT/FLOOD
SPINDL/5093,CLW
FEDRAT/0.05,IPM
GOLFT/L5,PAST,L6
GORGT/L6,PAST,L7
GORGT/L7,TO,L8
GOLFT/L8,PAST,L9
GORGT/L9,PAST,L10
GORGT/L10,PAST,L11
GORGT/L11,PAST,L12
GOLFT/L12,TO,L13
GORGT/L13,PAST,L14
GORGT/L14,PAST,L5
RAPID
GOTO/PTARG
SPINDL/OFF
COOLNT/OFF
FINI
```