SINGAPORE POLYTECHNIC
E-Assignment REVISION (EST)

Diploma in Mechanical Engineering
2nd Year Full-Time

COMPUTER-AIDED MACHINING (CNC MILLING) Time Allowed : 1½ Hours

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Instructions to Candidates

1. Fill in your admission number and class on the cover page.
2. This is an e-Assignment. You are to download the assignment paper and part model from Blackboard. After you have completed the operations, you are to fill up the answers in the blanks provided on this paper.
3. Submit all your answers electronically on BB.
4. This paper consists of 4 pages.

ADMISSION NO: _____

CLASS: SELECT YOUR CLASS _____

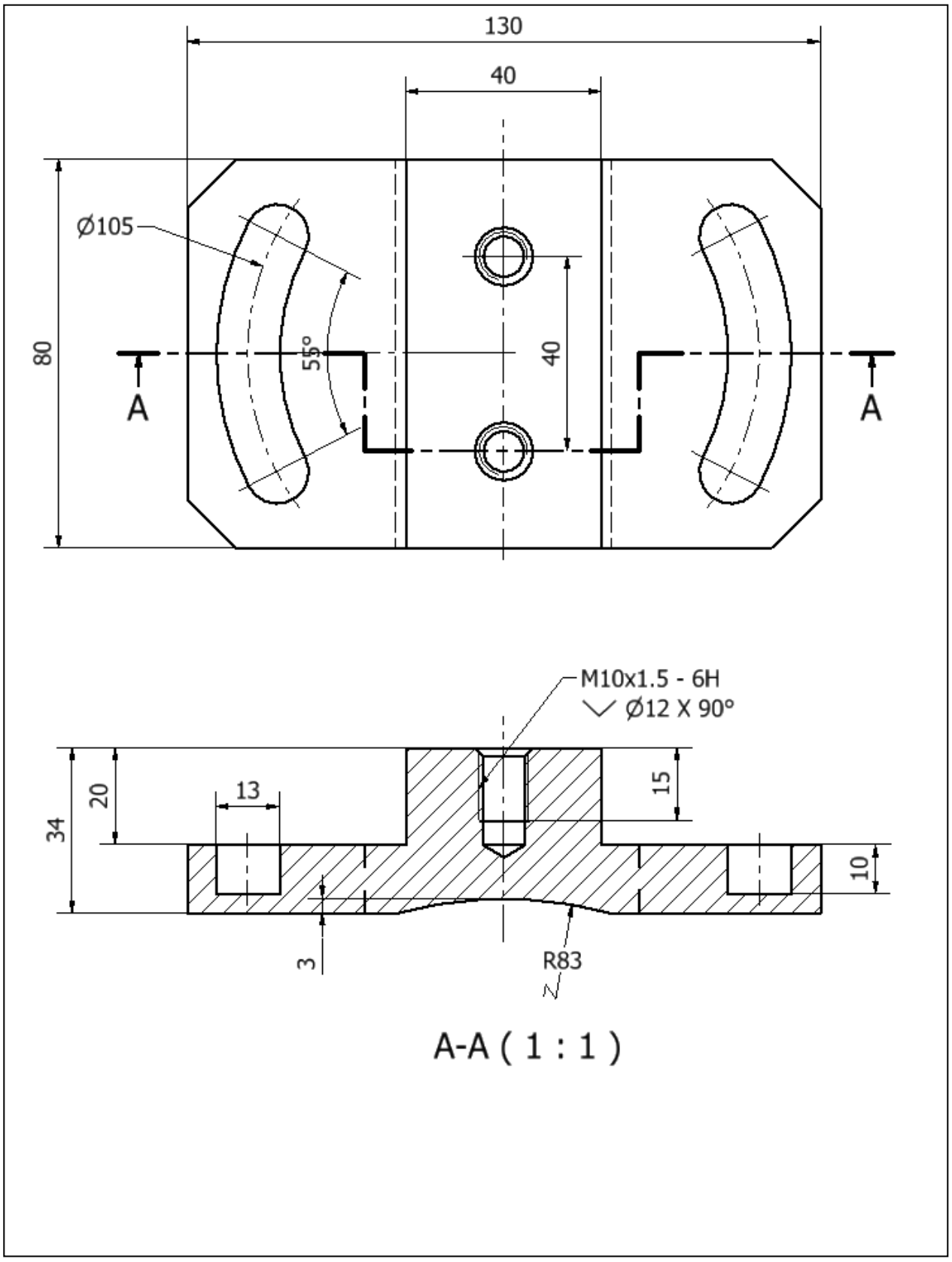
NAME:_____

_____

MARKER	
SCORE/100	

Answer the following Question (100 marks)

The following aluminum part (2024) is to be machined on CNC Machining Center, MAZAK V410A, with a raw rectangular stock, 150 x100 x 42mm. A standard Machine Vise is to be used to hold the part in machining.



To achieve desirable cutting conditions, you are to use biggest cutters whenever possible.
The following General machining Parameters are to be applied:-

1. Set Base cutting speed 60m/min
   Base feed per tooth/revolution 0.05mm
   Carbide Tool 400% of Base speed
   for machining Aluminium 2024

2. Linking Parameters
   Clearance: Abs 50mm
   Feed Plane: 5mm from actual cut surface

3. Contour Milling and Pocket Milling (Unless stated otherwise)
   After Roughing, 0.1mm should be left on walls for finishing cut

   For closed loop contour
   Lead In/Out with Line perpendicular and radius: 100% of Cutter dia, sweep angle 90 deg
   Closed contour overlap: 0mm
   Compensation by: Computer
   Compensated Direction: Left

   For Open loop contour:
   Lead In/Out with line tangent 100% of tool diammeter

5. Multi Passes Parameters - Spacing 75% of tool diameter

6. Keep Tool down in every operation whenever it is appropriate

7. Coolant has to be used

8. Use only tools in Table A for your machining operations.

9. Use Work Offset: G54 for Toolpath Group 1 G55 for Toolpath Group 2

Table A. Use the following Tools for your operations.

Tool No.	Tool type	Tool Mat'l	Cut Dia.	No. of flutes	Remarks
1	90^{o} Face Mill	Carbide	63	5	Taper angle 0 deg
2	Roughing Bull Endmill (corner R1)	Carbide	16	4	
3	Roughing Endmill	Carbide	10	4	
4	Roughing Endmill	Carbide	8	4	
5	Finishing Endmill	Carbide	16	6	
6	Finishing Endmill	Carbide	12	6	
7	Finishing Endmill	Carbide	10	6	
8	Finishing Endmill	Carbide	8	6	
9	Finishing Endmill	Carbide	6	6	
10	Ball Endmill	Carbide	2	2	
11	Spot Drill	HSS	10	-	Tip angle 90 deg
12	Spot Drill	HSS	16	-	Tip angle 90 deg
13	Twist drill	HSS	8.5	-	
14	Machine Tap	HSS	M10x1.5	4	Bottoming tip
15	Ball Endmill	Carbide	16	4	

You are required to prepare a MasterCam program with the following operations.
You should assign: Program No. 1331 for Toolpath Group 1
Program No. 1332 for Toolpath Group 2

(1 mark)

[DO NOT change the Mastercam default values unnecessarily. Use your discretion to complete the operations when needed]

Toolpath Group-1

a. Facing with Zigzag tool path and High speed loop between passes.
Facing amount: 0.5mm

b. Opti-Roughing with
Allowance 0.2mm on wall and 0.1 on floor surface
Containment set as the raw stock size
Surface Speed 240 m/min
Cut feed 4000 mm/min, Plunge rate 150 mm/min
10% Stepover
100% Stepdown
10% Stepup
Back Feedrate 8000 mm/min

c. 2D Pocketing of circular slots with **Ramping** technique
Constant overlap spiral – stepover 50%
Max rough step 5mm
Ensure Tool ramps into workpiece

d. Finish 2D Outer Contour

e. Finish 2D Contour milling 20mm steps – face and side wall

f. Finish contour milling of circular slots
Ensure Lead in/out with Line perpendicular and length/radius 25% of tool dia
Sweep angle 90 deg

g. Spot drilling

h. Peck drilling – 50% peck depth

i. Rigid tapping – Spindle speed 200rpm

Toolpath Group-2

j. Establish new Coordinate system (G55) and Face Mill (Zig-zag toolpath) and High Speed Loop to required thickness, Max rough step 1.5mm

(1 mark)

k. 3D Roughing Pocket
Stock to leave 0.5mm
Max stepdown 2mm
Ensure cutter does not plunge on work
Roughing with constant overlap spiral 75% overlap

l. **Use the most suitable tool**
3D Finishing Flowline
Scallop height 0.01mm

Tabulate Details of your Operations

	Cycle Time (Feed)		Path Length Feed
	min	sec	mm
Toolpath Group 1			
a) Face Milling			
b) Opti-Rough			
c) 2D Pocketing			
d) Finish Outer Contour			
e) Finish milling 20mm steps			
f) Finish Contour milling circular slots			
g) Spot drilling			
h) Peck drilling			
i) Rigid tapping			
Toolpath Group 2			
j) Face Milling			
k) 3D roughing pocket			
l) 3D finishing flow line			