Sample Test Project

State Level Skill Competitions

Skill- CNC Milling

Category: Manufacturing & Engineering Technology

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Section - A

A. Preface

Skill Explained:

CNC-milling machines are machine tools which are used for the shaping of metal and other solid materials. CNC refers to a computer (“control”) that reads and stores instructions which is used to control and drives a machine tool, a powered mechanical device (“machining center”). A machining center is used to fabricate components using cutting tools for removal of material.

To form the finished part, the cutting process can be started from a solid block, premachined part, casting, or forgings.

The skill requires the CNC-milling machinist to read and interpret complex technical drawings and work to a high degree of precision.

A Programme is required to operate the machine tool, can be generated manually or using Computer Aided Design, CAD/CAM Software.

Large enterprises such as automobile plants, medium sized enterprises such as mould making and small enterprises in the maintenance field are few examples of where the CNC milling machinist professional plays a key, integral role to the success of the metalwork industries.

Eligibility Criteria (for India Skills 2023 and World Skills 2024):

Competitors born on or after 01 Jan 2002 are only eligible to attend the Competition.

Total Duration: 3:00 Hours

Section - B

B. Test Project

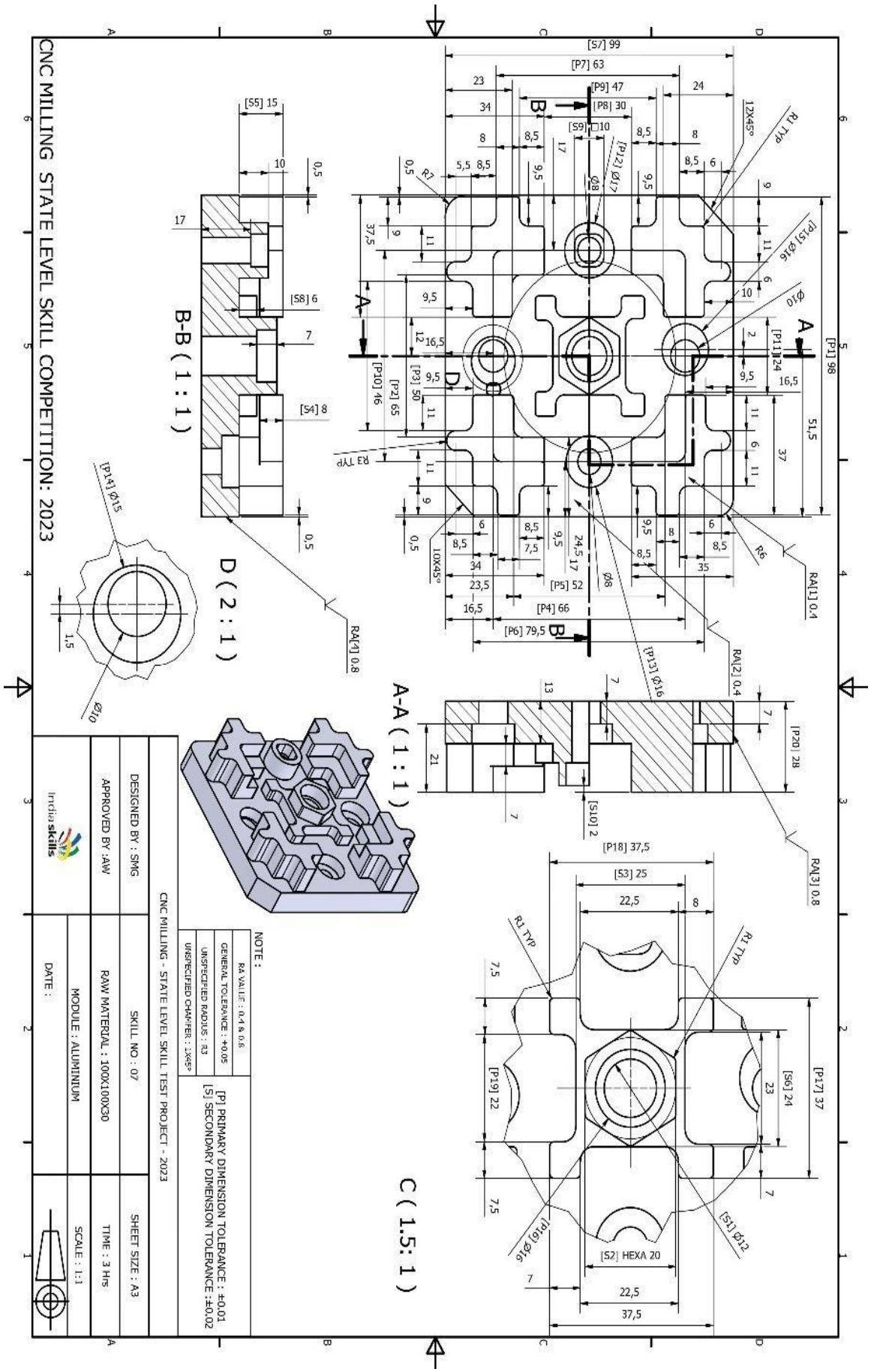
The test project will cover –

- Do the machining operation in CNC Milling machine.
- Do the program using latest Mastercam software.
- Planning the operations and sequences
- Selection of proper clamping methods to clamp the part correctly & safely
- Selection of proper cutting tools & tool parameters
- Setting offset values for the cutting tools
- Executing the machining process to get the final part as per blue print.

Perform the following machining operations:

Level 1 (*CNC Machining Process***)**

1. Facing
2. Roughing and finishing
3. External contours
4. Island milling
5. Pocket milling
6. Drilling


CNC MILLING STATE LEVEL SKILL COMPETITION: 2023
B-B (1 : 1)
D (2 : 1)
A-A (1 : 1)
C (1.5: 1)
NOTE :
R4 VALUE : 0.4 & 0.6
GENERAL TOLERANCE : ±0.05
UNSPECIFIED RADIUS : R3
UNSPECIFIED CHAMFER : 1X45°
[P] PRIMARY DIMENSION TOLERANCE : ±0.01
[S] SECONDARY DIMENSION TOLERANCE :±0.02
CNC MILLING - STATE LEVEL SKILL TEST PROJECT - 2023
DESIGNED BY : SMG
SKILL NO : 07
SHEET SIZE : A3
APPROVED BY :AW
RAW MATERIAL : 100X100X30
TIME : 3 Hrs
MODULE : ALUMINIUM
SCALE : 1:1
DATE :

Section – C

C. Marking Scheme

Marking Scheme:

The Assessment is done by awarding points by adopting two methods - Measurement and Judgments

- **Measurement –**
  It is used to assess the aspect which is measurable. It is used to assess the accuracy & precision of the dimensions of the Test Project

- **Judgment –**
  It is used to assess other performance which can be measured in a robust way. It is used where there should be no ambiguity.

  Judgments are made based on Industry expectations. It is used to assess the quality of performance, for which there may be small differences of view when applying the external benchmarks.

  Aspects are criteria's which are judged for assessment

ASSESSMENT AND MARKING USING JUDGEMENT

Judgment uses a scale of 0-3. The 0-3 scale to indicate:

- ❖ 0: performance below industry standard
- ❖ 1: performance meets industry standard
- ❖ 2: performance meets and, in specific respects, exceeds industry standard
- ❖ 3: performance wholly exceeds industry standard and is judged as excellent

SKILL ASSESSMENT SPECIFICATION

A – Main dimensions (50 out of 100 marks)

Dimensions range from +/-0.01 oriented of the nominal size

B – Secondary dimensions (25 out of 100 marks)

Dimensions range from +/-0.02 oriented of the nominal size.

C – Surface quality (10 out of 100 marks)

Surface quality = Ra 0.4 to 0.8

D – Conformity with drawing (10 out of 100 marks)

D1 Chamfering edges by machine 2 marks

D2 Chamfering edges manual 2 marks

D3 Contour damage 2 marks

D4 Conformity with drawing – face one 2 marks

D5 Clamping marks, Scratches 2 marks

E- Material Usage (5 out of 100 marks)

The specific Marking Scheme will be finalized during the Skill Specific meet organized before the competitions

Measurement Marking Form

Skill No: 07 **Skill Name: CNC MILLING**
Competitor No: **Competitor Name:**
Sub Criterion: Main Dimension

SI NO	Criteria	Requirement or Nominal Size	Max Mark	Marks Awarded
01	P1	98.0 ±0.01	2.5	
02	P2	65.0 ±0.01	2.5	
03	P3	50.0 ±0.01	2.5	
04	P4	66.0 ±0.01	2.5	
05	P5	52.0 ±0.01	2.5	
06	P6	79.5 ±0.01	2.5	
07	P7	63.0 ±0.01	2.5	
08	P8	30.0 ±0.01	2.5	
09	P9	47.0 ±0.01	2.5	
10	P10	46.0 ±0.01	2.5	
11	P11	24.0 ±0.01	2.5	
12	P12	Ø 17.0 ±0.01	2.5	
13	P13	Ø 16.0 ±0.01	2.5	
14	P14	Ø 15.0 ±0.01	2.5	
15	P15	Ø 16.0 ±0.01	2.5	
16	P16	Ø 16.0 ±0.01	2.5	
17	P17	37.0 ±0.01	2.5	
18	P18	37.5 ±0.01	2.5	
19	P19	22.0 ±0.01	2.5	
20	P20	28.0 ±0.01	2.5	

Grand Total	

Signature's confirming the accuracy of the printed result

Jury Member's	Date:
J1.	
J2.	Time:
J3.	

Measurement Marking Form

Skill No: 07 **Skill Name: CNC MILLING**
Competitor No: **Competitor Name:**
Sub Criterion: Secondary Dimension

SI NO	Criteria	Requirement or Nominal Size	Max Mark	Marks Awarded
01	S1	Ø 12.0 ±0.02	2.5	
02	S2	Hexa 20.0 ±0.02	2.5	
03	S3	25.0 ±0.02	2.5	
04	S4	8.0 ±0.02	2.5	
05	S5	15.0 ±0.02	2.5	
06	S6	24.0 ±0.02	2.5	
07	S7	99.0 ±0.02	2.5	
08	S8	6.0 ±0.02	2.5	
09	S9	Sq. 10.0 ±0.02	2.5	
10	S10	2.0 ±0.02	2.5	

Grand Total	

Signature's confirming the accuracy of the printed result

Jury Member's	
J1.	Date:
J2.	Time:
J3.	

Judgment Marking Form

Skill No: 07 **Skill Name: CNC MILLING**
Competitor No: **Competitor Name:**
Sub Criterion: Conformity with drawing

SI NO	Max Mark	Aspect of sub Criterion-Description	Jury Score (0 to 3)			Mark Awarded
			J1	J2	J3	
1	2	Chamfering edges by m/c				
2	2	Chamfering edges by manual				
3	2	Contour Damage				
4	2	Conformity with drawing _Face 1				
5	2	Clamping Marks, Scratches Mark.				

Grand Total	

Signature's confirming the accuracy of the printed result

Jury Member's	Date:
J1.	
J2.	Time:
J3.	

Measurement Marking Form

Skill No: 07 **Skill Name: CNC MILLING**
Competitor No: **Competitor Name:**
Sub Criterion: Surface Quality

SI NO	Criteria	Requirement or Nominal Size	Max Mark	Marks Awarded
01	Ra [1]	0.4	2.5	
02	Ra [2]	0.4	2.5	
03	Ra [3]	0.8	2.5	
04	Ra [4]	0.8	2.5	

Grand Total	

Signature's confirming the accuracy of the printed result

Jury Member's	
J1.	Date:
J2.	Time:
J3.	

MARKING SUMMARY FORM

Skill No: 07 **Skill Name: CNC MILLING**

Competitor No: **Competitor Name:**

Main Criteria	Max Marks	Actual Marks
Main Dimension	50	
Secondary Dimension	25	
Conformity to Drawing	10	
Surface Finish	10	
Use of Material	05	
Grand Total	100	

RESULT CONFIRMED BY -	SIGNED WITH DATE
JURY NO. 01	
JURY NO. 02	
JURY NO. 03	

Section - D

D. Infrastructure List

- Workshop Installation-Tools & Equipment positioned by Organizers
- Tool Kit-Tool & Equipment allowed to be brought by competitors for competitions

The above will be decided during the Skill Specific Workshop. The draft Infrastructure List details is as under mentioned

The Infrastructure list quantity can vary based on number of participants

SI NO	Description	Qty	Remark
1	work table		
2	Chair		
3	Computer		
4	Working vice		
5	Milling Machine CNC		
7	compressed air		
8	Air gun		
9	Soft hammer		
10	Cleaning waste		
11	Cutting oil		
12	Raw materials (for competition)		
13	Raw materials (for familiarization)		
	CUTTING TOOLS		
14	NC Centre Drills 90º Ø8.0		
15	NC Centre Drills 90º Ø10.0		
16	HSS Drills Ø6.00		
17	HSS Drills Ø7.50		
18	HSS Drills Ø11.50		
19	End Mill (roughing) Ø6.0		
20	End Mill (roughing) Ø10.0		
21	End Mill (roughing) Ø12.0		
22	End Mill (roughing) Ø16.0		
23	End Mill (finishing) Ø6.0		
24	End Mill (finishing) Ø8.0		
25	End Mill (finishing) Ø10.0		
26	End Mill (finishing) Ø12.0		
27	End Mill (finishing) Ø16.0		
28	Chamfer End Mill Ø6.0 [45˚]		

	MEASURING INSTRUMENTS		
29	Digital Vernier caliper 0-150 mm		
30	Dial Vernier caliper 0-150 mm		
31	Outside micrometers 0-25		
32	Outside micrometers 25-50		
33	Outside micrometers 50-75		
34	Outside micrometers 75-100		
35	Depth micrometers 0-25		
36	Plain protractor		
37	Dial indicators with magnetic stand		
38	Universal dial (0.01mm)		
39	Scriber		
	HOLDING DEVICES		
40	M/C Vice		
41	Clamping bolts		
42	Spanners		
43	Set of Allen key		
44	BT 40 Adapter 8 NO		
45	Collets (Ø6, Ø8, Ø10, Ø12, Ø16)		Each 2 NO.
46	Set of Parallels		
47	Mirror		

Section – E

E. Instructions for candidates

The Participating Competitors must consider the following;

- Experts shall not be allowed to give any help to Competitors to interpret the Test Project except where agreed by the Jury before the start of the competition
- Competitors have the right to expect fairness, honesty, and transparency during the Competition
- Every Competitor has the right to expect that no other Competitor will receive unfair assistance or any intervention that may provide an advantage
- Interference by officials or spectators that may hinder or assist Competitors in the completion of their Test Project is forbidden
- Accredited personnel at the Competition shall ensure that the above principles of honesty, fairness and transparency are observed at all times
- When the Competition is over, Competitors shall be given time to exchange views and experiences with other Competitors and Experts.
- In case a Competitor has to withdraw due to illness or accident; marks will be awarded for the work completed.
- In the event of Competitor fall ill or has an accident must be informed to Expert (Jury member)

Check points for the competitor

- ✓ Check the raw material size before start
- ✓ Debur properly while clamping the work piece
- ✓ Check the clamping rigidity (clamping pressure)
- ✓ Use goggles (PPE)

- ✓ Work with safety shoes
- ✓ Never move the hand or body near the running spindle
- ✓ Check the cutting tool condition
- ✓ Use proper cutting parameter
- ✓ Make sure the finished part is bur free
- ✓ Calibrate the measuring instrument before use
- ✓ Plan the machining operation sequence

Section – F

F. Health, Safety, and Environment

1. All accredited participants and supporting volunteers will abide by rules and regulations with regards to Health, Safety, and Environment of the Competition venue.

2. All participants, technicians and supporting staff will wear the required Personnel Protective equipment. Protective clothing must be selected according to the activity and related risk

3. When working with rotating machines, individuals must ensure that close-fitting clothing is worn, in order to avoid clothing becoming entangled in the equipment. Jewelry and long hair are a safety hazard and shall be taken off or covered.

4. All participants will assume liability for all risks of injury and damage to property, loss of property, which might be associated with or result from participation in the event. The organizers will not be liable for any damage; however, in case of Injury the competitor will immediately inform the immediate organizer for medical attention.