

MILLING OPERATIONS

UNIT CODE : 0715 351 04A

TVET CDACC UNIT CODE: ENG/CU/MMO/CR/04/4/MA

Relationship to Occupational Standards:

This unit addresses the unit of competency: Operate Conventional Milling Machine

Duration of Unit: 150 HRS

Unit Description

This unit covers the competencies required in operating conventional milling machine. It involves preparing working drawing, preparing milling operation plan, preparing milling cutting tools, setting up milling machine, producing parts by milling operations, inspecting finished work and maintaining milling machine and tools

Summary of Learning Outcomes

By the end of the unit the student should be able to:

S/NO	Learning Outcomes	Hours
1.	Interpret Working drawings interpretation	20
2.	Set work piece and tool(s) on milling machine	20
3.	Set up Milling machine	20
4.	Produce parts by Milling machine operations	80
5.	Carry out Milling machine maintenance	10
TOTAL		150 HRS

Learning Outcomes, Content and suggested assessment methods

Learning Outcome	Content	Suggested Assessment Methods
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1. Interpret Working drawings	1.1 Reading and extraction of information 1.1.1 Dimensions 1.1.2 Tolerances 1.1.3 BS/ANSI drawing standards 1.1.4 Geometric ISO symbols & abbreviations 1.2 Free hand sketching 1.3 Milling cutters and accessories 1.4 Types of milling machine 1.4.1 Vertical 1.4.2 Horizontal 1.4.3 Universal 1.5 Advantages and disadvantage of milling machines 1.6 Parts of the milling machine 1.6.1 Functions of each part 1.7 Milling machine operations 1.7.1 Face milling 1.7.2 Progressive milling 1.7.3 Profile milling 1.7.4 End milling 1.7.5 Form milling 1.7.6 Gang milling 1.7.7 Slot milling 1.7.8 Angular milling 1.7.9 Slitting 1.7.10 Slab milling 1.7.11 Straddle milling 1.7.12 Gear milling 1.8 Definition of operation plan	• Written Tests • Practical tests • Project Work • Portfolio of Evidence
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	1.8.1 Structure of an operation plan 1.9 Milling operation sequence 1.9.1 Procedure 1.10 Milling parameters 1.10.1 Cutting speed 1.10.2 Feed rate 1.10.3 Material removal rate 1.10.4 Depth of cut 1.11 Milling machine tools and accessories 1.11.1 Work holding devices 1.11.2 Angular table 1.11.3 Rotary table 1.11.4 Dividing head 1.11.5 Plain table 1.11.6 clamps 1.12 Materials 1.12.1 Types 1.12.2 Mild steel 1.12.3 Brass 1.12.4 Aluminium 1.13 Forms of supply 1.13.1 Bars 1.13.2 Plates 1.13.3 shaft	
2.Set work piece and tool(s) on milling machine	2.1 Safety 2.1.1 PPE 2.1.2 Safe workplace 2.1.3 Machine safety 2.1.3.1 Machine Guard	• Written Tests • Practical tests • Project Work • Portfolio of Evidence

	2.1.3.2 Emergency buttons and foot brakes 2.1.4 machine Working condition 2.1.5 Housekeeping operations 2.1.5.1 Record keeping 2.1.5.2 Cleaning of work environment (waste sorting and disposal) 2.1.5.3 Cleaning and storing of finished work, tools and equipment 2.2 Types of milling cutters 2.3 Grinding of milling cutters 2.4 Selection and mounting of Tool inserts 2.4.1 Types of inserts 2.4.1.1 Surface cutter insert 2.4.1.2 T slot cutter 2.4.1.3 Face cutter inserts 2.4.1.4 Slot milling inserts 2.4.2 Application of inserts	
3.Set up Milling machine	3.1 Check the machine conditions 3.1.1 Functioning of control buttons 3.1.2 Oil level 3.1.3 Cutting fluid level 3.1.4 Machine is ready to use 3.2 Selection of Machine tools and accessories 3.3 Setting the milling machine tool and accessories	• Written Tests • Practical tests • Project Work • Portfolio of Evidence

	3.4 Mounting of work piece 3.4.1 Setting the work at the centre 3.5 Cutting fluids 3.5.1 Types 3.5.2 Composition 3.5.3 Selection and application 3.5.4 Importance 3.6 Setting the milling machine parameters 3.6.1 Feed rate 3.6.2 Depth of cut 3.6.3 Spindle speed	
4. Produce parts by Milling machine operations	4.1 Safety during milling operation 4.2 Milling operation procedure 4.3 Milling machine parameters 4.4 Check and rectify the dimension discrepancies 4.5 Inspection 4.5.1 Tools and equipment 4.5.2 Dimension tolerances 4.5.3 Surface finish 4.5.3.1 visual inspection 4.5.4 Discrepancies 4.6 Functionality test	• Written Tests • Practical tests • Project Work • Portfolio of Evidence
5. Carry out Milling machine maintenance	5.1 Types of maintenance 5.1.1 Preventive 5.1.2 Scheduled 5.1.3 Routine 5.2 Trouble shooting 5.2.1 Fault diagnosis	• Written Tests • Practical tests • Project Work Portfolio of Evidence

	5.3 Servicing of milling machine, tools and accessories 5.3.1 Inspection 5.3.2 Storage 5.3.3 Lubrication 5.3.4 Alignment and adjustment 5.4 Maintenance report and logs	
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Suggested Delivery Methods

- Demonstration by trainer
- Discussions
- Practical work by trainee(s)
- Exercises
- Industrial visits
- YouTube for teaching/learning and inspiration
- Simulation

Recommended Resources for 25 trainees

S/No.	Category/Item	Description/Specifications	Quantity	Recommended Ratio (Item: Trainee)
A	Learning Materials			
1.	Textbooks	For reference	5 pcs	1:5
2.	Installation manuals	For reference	Adequate	
3.	Charts	For reference	Adequate	
4.	Computer	For instruction	5	1: 5
B	Learning Facilities & Infrastructure			

1.	Lecture/theory room	9M × 12M	1	1:25
2.	Workshop	20M × 20M	1	1:25
3.	Laboratory	9M × 12M	1	1:25
4.	Work benches	1.5M × 1.2M	7	1:4
5.	Bench Vices		2	2:25
	Safety			
1.	Safety goggles		25 pcs	1:1
2.	Leather glove		25 pairs	1:1
3.	Ear muffs		25 pcs	1:1
4.	Overall		25 pcs	1:1
5.	Safety boots		25 pairs	1:1
6.	Dust mask		25 pcs	1:1
7.	Face shield		25 pcs	1:1
C	Consumable Materials			
1.	First aid kit	Adequate		
2.	Cutting oil	Adequate		
3.	Fire extinguisher	Adequate		
4.	Ream of Drawing papers	Adequate		
5.	Cleaning detergents	Enough		
6.	Cotton wool waste	Enough		
	Raw material			
7.	Aluminum round bar	1 length	1pc	1:25
8.	Mild steel round bar	1 length	1pc	1:25
9.	Nylon / PTFE round bar		1pc	
10.	Aluminum plate	8ft×4ft	1pc	1:25
11.	Mild steel plate	8ft×4ft	1pc	1:25
12.	Brass plate	8ft×4ft	1pc	1:25
13.	Nylon / PTFE plate	8ft×4ft	1pc	1:25

E	Tools and Equipment			
1.	Measuring Tools			
2.	Steel rule		25 pcs	1:1
3.	Micrometre screw gauge		5pcs	1:5
4.	Vanier callipers		5 pcs	1:5
5.	Tri square		25 pcs	1:1
6.	Bevel protractor		2pcs	1:13
7.	Combination set		2pcs	1:13
8.	Measuring tapes		5 pcs	1:5
	Marking Out Tools			
1.	Vanier height gauge		2 pcs	1:13
2. \	Surface plate		2pcs	1:13
3.	Angle plate		2pcs	1:13
4.	Scribers		5 pcs	1:5
5.	Dot punch		5 pcs	1:5
6.	Divider		13pcs	1:2
7.	Center punch		5pcs	1:5
	Cutting Tools			
8.	Plain milling cutters	set	2pcs	1:13
9.	Side milling cutters	set	2pcs	1:13
10.	End milling cutters	set	2pcs	1:13
11.	Face milling cutters	set	2pcs	1:13
12.	Surface cutter	set	2pcs	1:13
13.	Metal slitting cutters	set	2pcs	1:13
14.	Angle milling cutters	set	2pcs	1:13
15.	Milling machine		2 pcs	2:25
	Milling inserts			
1.	Side milling cutter	set	3 pcs	1:8

2.	Face milling cutter	set	3pcs	1:8
3.	Surface cutter	set	3 pcs	1:8
	Finishing machine and materials			
	Buffing machine		3pc	1:8
	Emery cloth		1 roll	1:25

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