

MACHINING LEVEL – II



CURRICULUM

Based on **December, 2021** (V- III) Occupational
Standard (OS)

March, 2022
Addis Ababa, Ethiopia

Preface

The reformed TVET-System is an outcome-based system. It utilizes the needs of the labor market and occupational requirements from the world of work as the benchmark and standard for TVET delivery. The requirements from the world of work are analyzed and documented – taking into account international benchmarking – as occupational standards (OS).

In the reformed TVET-System, curricula and curriculum development play an important role with regard to quality driven comparable TVET-Delivery. The Curricula help to facilitate the training process in a way, that trainees acquire the set of occupational competences (skills, knowledge and attitude) required at the working place and defined in the occupational standards (OS).

This curriculum has been developed by a group of professional experts from different Regional TVET Bureaus, colleges, Industries, Institutes and universities based on the occupational standard for Machining Level II.

The curriculum development process has been actively supported and facilitated by **Ministry of Labor and Skills**.

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TVET-Program Design

1.1. TVET-Program Title: Machining Level II

1.2. TVET-Program Description

The Program is designed to develop the necessary knowledge, skills and attitude of the trainees to the standard required by the occupation. The contents of this program are in line with the occupational standard. The trainees who successfully completed the Program will be qualified to work as a **machinist** with competencies elaborated in the respective OS. Graduates of the program will have the required qualification to work in the **Industry** sector in the field of Machining. The prime objective of this training program is to equip the Trainees with the identified competences specified in the OS. Graduates are therefore expected to **Prepare Basic Engineering Drawing, Perform CAD Operation, Maintain Tools and Equipment, Perform Intermediate Lathe Operations, Perform Intermediate Milling Operations, Perform Intermediate Grinding operations, Perform machining operations using horizontal and vertical boring, Perform precision shaping/planning/slotting operations**, in accordance with the performance criteria and evidence guide described in the OS.

1.3. TVET-Program Training Outcomes

The expected outputs of this program are the acquisition and implementation of the following units of competences:

IND MAC2 01 1221 Prepare Basic Engineering Drawing

IND MAC2 02 0221 Perform CAD Operation

IND MAC2 03 0221 Maintain Tools and Equipment

IND MAC2 04 0221 Perform Intermediate Lathe Operations

IND MAC2 05 0221 Perform Intermediate Milling Operations

IND MAC2 06 0221 Perform Intermediate Grinding Operations

IND MAC2 07 0221 Perform machining operations using horizontal and vertical boring

IND MAC2 08 0221 Perform precision shaping/planning/slotting operations

1.4. Duration of the TVET-Program

The Program will have duration of **670 hours** including the on school/ Institution training and on-the-job practice or cooperative training time. Such cooperative training based on realities of the industry, nature of the occupation, location of the TVET institution, and other factors will be considered in the training delivery to ensure that trainees acquire practical and workplace experience.

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S.No	Unit Competency	TVET Institution Training		Cooperative Training	Total Hours	Remarks
		Theory	Practical			
1.	Prepare Basic Engineering Drawing	24	40	16	80	
2.	Perform CAD Operation	36	60	24	120	
3.	Maintain Tools and Equipment	15	25	10	50	
4.	Perform Intermediate Lathe Operations	36	60	24	120	
5.	Perform Intermediate Grinding Operations	36	60	24	120	
6.	Perform Intermediate Milling Operations	18	30	12	60	
7.	Perform precision shaping/planning/slotting operations	18	30	12	60	
8.	Perform machining operations using horizontal and vertical boring machine	18	30	12	60	
Total Hours					670 Hours	

1.5. Qualification Level and Certification

Based on the descriptors elaborated on the Ethiopian National TVET Qualification Framework (NTQF) the qualification of this specific TVET Program is **Level II**.

The trainee can exit after successfully completing the modules in one level and will be awarded the equivalent institutional certificate on the level completed. However, only institutional certificate of training accomplishment will be awarded.

1.6. Target Groups

Any citizen **with or without disability** who meets the entry requirements under items 1.7 and capable of participating in the training activities is entitled to take part in the Program.

1.7 Entry Requirements

The prospective participants of this program are required to possess the requirements or directive of the **Ministry of Labor and Skills**.

1.8 Mode of Delivery

This TVET-Program is characterized as a formal Program on middle level technical skills. The mode of delivery is co-operative training. The time spent by the trainees in the real work place/ industry will give them enough exposure to the actual world of work and enable them to get hands-on experience. The co-operative approach will be supported with school-based lecture-discussion, simulation and actual practice. These modalities will be utilized before the trainees are exposed to the industry environment.

Hence based on the nature of the occupation, location of the TVET institutions, and interest of the industry alternative mode of cooperative training such as apprenticeships, internship and traineeship will be employed. In addition, in the areas where industry is not sufficiently available the established production and service centers/learning factories in TVET institutions will be used as cooperative training places. The Training-Institution and identified companies have forged an agreement to co-operate with regard to the implementation of this program.

1.9. TVET-Program Structure

Unit of Competence	Module Code & Title	Training Outcomes	Duration (In Hours)
<u>IND MAC2 01 0221</u> Prepare Basic Engineering Drawing	<u>IND MAC2 M01 0322</u> Preparing Basic Engineering Drawing	<ul style="list-style-type: none"> Identify drawing requirements Prepare drawings or make changes to existing drawings Prepare engineering parts list Issue approved drawing 	80 hr
<u>IND MAC2 02 0221</u> Perform CAD Operation	<u>IND MAC2 M02 0322</u> Performing CAD Operation	<ul style="list-style-type: none"> Confirm drawing requirements Identify key features of CAD software Create 2D drawings Access software and set up for drawing work Produce basic drawing elements Complete CAD operations 	120 hr

<p><u>IND MAC2 03 0221</u> Maintain Tools and Equipment</p>	<p><u>IND MAC2 M03 0322</u> Maintaining Tools and Equipment</p>	<ul style="list-style-type: none"> • Undertake program safety and maintenance checks • Undertake basic program maintenance • Perform basic preventive maintenance of tools • Inventory tools and equipment 	<p>50 hr</p>
<p><u>IND MAC2 04 0221</u> Perform Intermediate Lathe Operations</p>	<p><u>IND MAC2 M04 0322</u> Performing Intermediate Lathe Operations</p>	<ul style="list-style-type: none"> • Determine job requirements • Set-up work piece • Perform lathe operations • Comply with Quality Assurance 	<p>120hr</p>
<p><u>IND MAC2 05 0221</u> Perform Intermediate Milling Operations</p>	<p><u>IND MAC2 M05 0322</u> Performing Intermediate Milling Operations</p>	<ul style="list-style-type: none"> • Determine job requirements • Set-up work piece • Perform milling operations • Check/ measure work piece 	<p>100 hr</p>
<p><u>IND MAC2 06 0221</u> Perform Intermediate Grinding Operations</p>	<p><u>IND MAC2 M06 0322</u> Performing Intermediate Grinding Operations</p>	<ul style="list-style-type: none"> • Set up work • Perform intermediate grinding operations • Quality assure components in conformance to 	<p>60 hr</p>

		specifications	
<u>IND MAC2 07 0221</u> Perform machining operations using horizontal and vertical boring	<u>IND MAC2 M07 0322</u> Performing machining operations using horizontal and vertical boring	<ul style="list-style-type: none"> • Determine job requirements • Set up work • Perform boring operations • Check component for conformance to specification • Identify inserts from Standards • Adjust and maintain machine • Clean up 	50 hr
<u>IND MAC2 08 0221</u> Perform precision shaping/planning/slotting operations	<u>IND MAC2 M08 0322</u> Performing precision shaping/planning/slotting operations	<ul style="list-style-type: none"> • Observe safety precautions • Determine job requirements • Perform precision shaping operations • Perform precision planning operations • Perform precision slotting operations • Check component for 	60 hr

		conformance to specification	
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*The time duration (Hours) indicated for the module should include all activities in and out of the TVET institute

1.10 Institutional Assessment

Two types of evaluation will be used in determining the extent to which training outcomes are achieved. The specific training outcomes are stated in the modules. In assessing them, verifiable and observable indicators and standards shall be used.

The **formative assessment** is incorporated in the training modules and form part of the training process. Formative evaluation provides the trainee with feedback regarding success or failure in attaining training outcomes. It identifies the specific training errors that need to be corrected, and provides reinforcement for successful performance as well. For the teacher, formative evaluation provides information for making instruction and remedial work more effective.

Summative Evaluation the other form of evaluation is given when all the modules in the program have been accomplished. It determines the extent to which competence have been achieved. And, the result of this assessment decision shall be expressed in the term of institutional Assessment implementation guidelines..

Techniques or tools for obtaining information about trainees' achievement include oral or written test, demonstration and on-site observation.

1.11 TVET Teachers Profile

The teachers conducting this particular TVET Program are B Level and above who have satisfactory practical experiences or equivalent qualifications.

LEARNING MODULE 01

TVET-PROGRAMME TITLE: **Machining Level II**

MODULE TITLE: **Preparing Basic Engineering Drawing**

MODULE CODE: [IND MAC2 M01 03 22](#)

NOMINAL DURATION: **100 Hours**

MODULE DESCRIPTION: This module covers the knowledge, skills and attitudes required to perform manual drafting and metal engineering drawings, part and material lists.

LEARNING OUTCOMES

At the end of the module the trainee will be able to:

- LO1.** Identify drawing requirements
- LO2.** Prepare drawings or make changes to existing drawings
- LO3.** Prepare engineering parts list
- LO4.** Issue approved drawing

MODULE CONTENTS:

LO1. Identify drawing requirements

- 1.1 Determining specifications and other data.
- 1.2 Identifying and analyzing necessary data of norm/ standards drawing.
- 1.3 Verifying drawing requirements.
 - 1.3.1 Drawing symbols and standards
 - 1.3.2. Types and uses of drafting equipment and drawing instruments
 - 1.3.3. Using measuring instruments
 - 1.3.4 Establishing relevant personnel.

LO2. Prepare drawings or make changes to existing drawings

- 2.1 Applying drafting principles.
 - 2.1.1. Local standards
 - 2.1.2. International standards
- 2.2. Indicating dimensions, notes and specifications
- 2.3. Presenting complete drawings.

LO3. Prepare engineering parts list

- 3.1 Identifying and organizing Component parts and material.
- 3.2. Completing part lists records
 - 3.3 Isometric, orthographic and exploded view drafting
 - 3.4 ISO Tolerances and fits

LO4 Issue approved drawing

4.1 Copying and issuing drawing and norm parts lists.

4.2 Storing and cataloguing drawings and norm parts lists

Learning Methods:				
For none impaired trainees	Reasonable Adjustment for Trainees with Disability (TWD)			
	Low Vision	Deaf	Hard of hearing	Physical impairment
Lecture discussion	<ul style="list-style-type: none"> ✚ Provide large print text ✚ Prepare the lecture in Audio/video ✚ Organize the class room seating arrangement to be accessible to trainees ✚ Write short notes on the black/white board using large text ✚ Make sure the luminosity of the light of class room is kept ✚ Use normal tone of voice ✚ Encourage trainees to record the lecture in audio format ✚ Provide Orientation on the physical feature of the work shop ✚ Summarize main points 	<ul style="list-style-type: none"> ✚ Assign sign language interpreter ✚ Arrange the class room seating to be conducive for eye to eye contact ✚ Make sure the luminosity of the light of class room is kept ✚ Introduce new and relevant vocabularies ✚ Use short and clear sentences ✚ Give emphasis on visual lecture and ensure the attention of the trainees ✚ Avoid movement during lecture time ✚ Present the lecture in video format 	<ul style="list-style-type: none"> ✚ Organize the class room seating arrangement to be accessible to trainees ✚ Speak loudly ✚ Ensure the attention of the trainees ✚ Present the lecture in video format ✚ Ensure the attention of the trainees 	<ul style="list-style-type: none"> ✚ Organize the class room seating arrangement to be accessible for wheelchairs users. ✚ Facilitate and support the trainees who have severe impairments on their upper limbs to take note ✚ Provide Orientation on the physical feature of the work shop

		❖ Summarize main points		
Demonstration	<ul style="list-style-type: none"> ✚ Conduct close follow up ✚ Use verbal description ✚ Provide special attention in the process of guidance ✚ facilitate the support of peer trainees ✚ Prepare & use simulation 	<ul style="list-style-type: none"> ✚ use Sign language interpreter ✚ Use video recorded material ✚ Ensure attention of the trainees ✚ Provide structured training ✚ Show clear and short method ✚ Use gesture ❖ provide tutorial support (if necessary) 	<ul style="list-style-type: none"> ✚ Illustrate in clear & short method ✚ Use Video recorded material ✚ Ensure the attention of the trainees ❖ provide tutorial support (if necessary) 	<ul style="list-style-type: none"> ✚ Facilitate and support the trainees having severe upper limbs impairment to operate equipment / machines ✚ Assign peer trainees to assist ✚ Conduct close follow up ❖ provide tutorial support (if necessary)
Group discussion	<ul style="list-style-type: none"> ✚ Facilitate the integration of trainees with group members ✚ Conduct close follow up ✚ Introduce the trainees with other group member ✚ Brief the thematic issues of the work 	<ul style="list-style-type: none"> ✚ Use sign language interpreters ✚ Facilitate the integration of trainees with group members ✚ Conduct close follow up ✚ Introduce the trainees with other group member 	<ul style="list-style-type: none"> ✚ Facilitate the integration of trainees with group members ✚ Conduct close follow up ✚ Introduce the trainees with other group member 	<ul style="list-style-type: none"> ❖ Introduce the trainees with their peers

			❖ Inform the group members to speak loudly	
Exercise	<ul style="list-style-type: none"> ✚ Conduct close follow up and guidance ✚ Provide tutorial support if necessary ✚ provide special attention in the process 	<ul style="list-style-type: none"> ✚ Conduct close follow up and guidance ✚ Provide tutorial support if necessary ✚ provide special attention in the process/practical training ✚ Introduce new and relevant vocabularies 	<ul style="list-style-type: none"> ✚ Conduct close follow up and guidance ✚ Provide tutorial support if necessary ✚ provide special attention in the process/ practical training 	<ul style="list-style-type: none"> ✚ Assign peer trainees ✚ Use additional nominal hours if necessary
Individual assignment	<ul style="list-style-type: none"> ✚ prepare the assignment questions in large text ✚ Encourage the trainees to prepare and submit the assignment in large texts ✚ Make available recorded assignment questions ✚ Facilitate the trainees to prepare and submit the assignment in soft or hard copy 	<ul style="list-style-type: none"> ✚ Use sign language interpreter ✚ Provide briefing /orientation on the assignment ✚ Provide visual recorded material 	<ul style="list-style-type: none"> ✚ Provide briefing /orientation on the assignment ✚ Provide visual recorded material 	

ASSESSMENT METHODS:				
Interview		<ul style="list-style-type: none"> ✚ Use sign language interpreter ✚ Ensure or conform whether the proper communication was conducted with the trainee through the service of the sign language interpreter ✚ Use short and clear questioning ✚ Time extension 	<ul style="list-style-type: none"> ✚ Speak loudly ✚ Using sign language interpreter if necessary 	<ul style="list-style-type: none"> ❖ Use written response as an option for the trainees having speech challenges
Written test	<ul style="list-style-type: none"> ✚ Prepare the exam in large texts ✚ Use interview as an option if necessary ✚ Prepare the exam in audio format ✚ Assign human reader ✚ (if necessary) ✚ Time extension 	<ul style="list-style-type: none"> ✚ Prepare the exam using short sentences, multiple choices, True or False, matching and short answers ✚ Avoid essay writing ✚ Time extension 	<ul style="list-style-type: none"> ❖ Prepare the exam using short sentences, multiple choices, true or false, matching and short answers if necessary. 	<ul style="list-style-type: none"> ✚ Use oral response as an option to give answer for trainees having severe upper limb impairment ✚ Time extension for trainees having severe upper limb impairment
Demonstration /Observation	<ul style="list-style-type: none"> ❖ Brief the instruction or provide them in large text 	<ul style="list-style-type: none"> ✚ Use sign language interpreter ✚ Brief on the instruction of the 	<ul style="list-style-type: none"> ✚ Provide activity based assessment ✚ Brief on the instruction of the exam 	<ul style="list-style-type: none"> ❖ Provide activity based assessment

	❖ Time extension	† Provide activity-based/ practical assessment method † Time extension	† Use loud voice † Time extension	† Conduct close follow up † Time extension
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ASSESSMENT CRITERIA:

LO.1 Identify drawing requirements

- Specifications and other data are determined from work order and specification, actual sample or relevant documents
- All necessary data are identified and analyzed to produce the norm/ standards drawing
- Drawing requirements are verified by relevant personnel and timeframes for completion are established in accordance with standard operating procedures

LO.2 Prepare drawings or make changes to existing drawings

- Drafting principles are applied to produce a drawing that is consistent with standard operating procedures
- Dimensions, notes and specifications are indicated in the drawing in accordance with drafting principles and standards
- Completed drawing is presented for approval in accordance with standard operating procedures
- Completed drawing is presented for approval in accordance with standard operating procedures

LO.3 Prepare engineering parts list

- Component parts and material are identified and organized by component type and/or in accordance with company/customer requirements
- Parts lists records are completed in accordance with standard operating procedures

LO.4 Issue approved drawing

- Approved drawing and/or norm parts lists are copied and issued to relevant personnel in accordance with standard operating procedures.
- Approved drawings and/or norm parts lists are stored and catalogued in accordance with standard operating procedures

Annex: Resource Requirements

IND MAC2 M01 03 22 Preparing Basic Engineering Drawing				
Item No.	Category/Item	Description/ Specifications	Quantity	Recommended Ratio (Item: Trainee)
A. Learning Materials				
1.	TTLM	TTTLM prepared by the trainer	25	1;1
2.	Reference Books	Machine drawing 3 rd edition by P.Kannaiah,K.Venkata Reddy	5	1:5
B. Learning Facilities & Infrastructure				
1.	Lecture Room	5*5m	1	1:25
2.	Library	STD	1	1:25
C. Consumable Materials				
1.	Copy Paper	A4,A3	5 pack	5:25
D. Tools and Equipment's				
1	White board	standard	1	1:25
2.	Computer Desk top, laptop	standard	25	1:1
3	LCD Projector	standard	1	1:25

LEARNING MODULE 02

TVET-PROGRAMME TITLE: **Machining Level II**

MODULE TITLE : **Performing CAD Operation**

MODULE CODE : **IND MAC2 M 02 0322**

NOMINAL DURATION : **120 Hours**

MODULE DESCRIPTION : This module covers the knowledge, skills and attitudes required to create drawings with the use of Computer Aided Design (CAD) software.

LEARNING OUTCOMES

At the end of the module the trainee will be able to:

- LO1.** Confirm drawing requirements
- LO2.** Identify key features of CAD software
- LO3.** Create 2D drawings
- LO4.** Access software and set up for drawing work
- LO5.** Produce basic drawing elements
- LO6.** Complete CAD operations

MODULE CONTENTS:

LO1. Confirm drawing requirements

- 1.1. Confirming purpose, scope, information for drawing
- 1.2. Identifying addressing available information. relevant to project.
- 1.3. Identifying and computing equipment and software.

LO2. Identify key features of CAD software

- 2.1. Describing and using types of CAD software
 - 2.1.1 AutoCAD
 - 2.1.2. Inventor
 - 2.1.3. CATIA
 - 2.1.3. Solid works
 - 2.1.4 Pro Steel
 - 2.1.5. X Steel
- 2.2. Identifying differences in CAD process to generate 2-D drawings, 3-D models,

LO3. Create 2D drawings

- 3.1 Creating drawings using the full capability of the available software system.
- 3.2. Attributing drawing entities linking to database
- 3.3. Creating detailing views using various scales.

LO4. Access software and set up for drawing work

- 4.1 Opening software and navigating organizational filing and library system.
- 4.2 Identifying and determining organizational software templates
- 4.3 Identifying organizational symbols, codes and standards

LO5. Produce basic drawing elements

- 5.1. Producing CAD functions to basic drawing elements
- 5.2. Using editing and transferring tools and methods
- 5.3. Applying dimensions, text and symbols
- 5.4 Importing and exporting Files
- 5.5. Generating different views and perspectives

LO6. Complete CAD operations

- 6.1. Saving and filing drawing elements.
- 6.2 Printing and evaluating drawing elements

Learning Methods:				
For none impaired trainees	Reasonable Adjustment for Trainees with Disability (TWD)			
	Low Vision	Deaf	Hard of hearing	Physical impairment
Lecture discussion	<ul style="list-style-type: none"> ✚ Provide large print text ✚ Prepare the lecture in Audio/video ✚ Organize the class room seating arrangement to be accessible to trainees ✚ Write short notes on the black/white board using large text ✚ Make sure the luminosity of the light of class room is kept ✚ Use normal tone of voice ✚ Encourage trainees to record the lecture in audio format ✚ Provide Orientation on the physical feature of the work shop ✚ Summarize main points 	<ul style="list-style-type: none"> ✚ Assign sign language interpreter ✚ Arrange the class room seating to be conducive for eye to eye contact ✚ Make sure the luminosity of the light of class room is kept ✚ Introduce new and relevant vocabularies ✚ Use short and clear sentences ✚ Give emphasis on visual lecture and ensure the attention of the trainees ✚ Avoid movement during lecture time ✚ Present the lecture in video format 	<ul style="list-style-type: none"> ✚ Organize the class room seating arrangement to be accessible to trainees ✚ Speak loudly ✚ Ensure the attention of the trainees ✚ Present the lecture in video format ✚ Ensure the attention of the trainees 	<ul style="list-style-type: none"> ✚ Organize the class room seating arrangement to be accessible for wheelchairs users. ✚ Facilitate and support the trainees who have severe impairments on their upper limbs to take note ✚ Provide Orientation on the physical feature of the work shop

		❖ Summarize main points		
Demonstration	<ul style="list-style-type: none"> ✚ Conduct close follow up ✚ Use verbal description ✚ Provide special attention in the process of guidance ✚ facilitate the support of peer trainees ✚ Prepare & use simulation 	<ul style="list-style-type: none"> ✚ use Sign language interpreter ✚ Use video recorded material ✚ Ensure attention of the trainees ✚ Provide structured training ✚ Show clear and short method ✚ Use gesture ❖ provide tutorial support (if necessary) 	<ul style="list-style-type: none"> ✚ Illustrate in clear & short method ✚ Use Video recorded material ✚ Ensure the attention of the trainees ❖ provide tutorial support (if necessary) 	<ul style="list-style-type: none"> ✚ Facilitate and support the trainees having severe upper limbs impairment to operate equipment / machines ✚ Assign peer trainees to assist ✚ Conduct close follow up ❖ provide tutorial support (if necessary)
Group discussion	<ul style="list-style-type: none"> ✚ Facilitate the integration of trainees with group members ✚ Conduct close follow up ✚ Introduce the trainees with other group member ✚ Brief the thematic issues of the work 	<ul style="list-style-type: none"> ✚ Use sign language interpreters ✚ Facilitate the integration of trainees with group members ✚ Conduct close follow up ✚ Introduce the trainees with other group member 	<ul style="list-style-type: none"> ✚ Facilitate the integration of trainees with group members ✚ Conduct close follow up ✚ Introduce the trainees with other group member 	<ul style="list-style-type: none"> ❖ Introduce the trainees with their peers

			❖ Inform the group members to speak loudly	
Exercise	<ul style="list-style-type: none"> ✚ Conduct close follow up and guidance ✚ Provide tutorial support if necessary ✚ provide special attention in the process 	<ul style="list-style-type: none"> ✚ Conduct close follow up and guidance ✚ Provide tutorial support if necessary ✚ provide special attention in the process/practical training ✚ Introduce new and relevant vocabularies 	<ul style="list-style-type: none"> ✚ Conduct close follow up and guidance ✚ Provide tutorial support if necessary ✚ provide special attention in the process/practical training 	<ul style="list-style-type: none"> ✚ Assign peer trainees ✚ Use additional nominal hours if necessary
Individual assignment	<ul style="list-style-type: none"> ✚ prepare the assignment questions in large text ✚ Encourage the trainees to prepare and submit the assignment in large texts ✚ Make available recorded assignment questions ✚ Facilitate the trainees to prepare and submit the assignment in soft or hard copy 	<ul style="list-style-type: none"> ✚ Use sign language interpreter ✚ Provide briefing /orientation on the assignment ✚ Provide visual recorded material 	<ul style="list-style-type: none"> ✚ Provide briefing /orientation on the assignment ✚ Provide visual recorded material 	

ASSESSMENT METHODS:				
Interview		<ul style="list-style-type: none"> ✚ Use sign language interpreter ✚ Ensure or conform whether the proper communication was conducted with the trainee through the service of the sign language interpreter ✚ Use short and clear questioning ✚ Time extension 	<ul style="list-style-type: none"> ✚ Speak loudly ✚ Using sign language interpreter if necessary 	<ul style="list-style-type: none"> ❖ Use written response as an option for the trainees having speech challenges
Written test	<ul style="list-style-type: none"> ✚ Prepare the exam in large texts ✚ Use interview as an option if necessary ✚ Prepare the exam in audio format ✚ Assign human reader ✚ (if necessary) ✚ Time extension 	<ul style="list-style-type: none"> ✚ Prepare the exam using short sentences, multiple choices, True or False, matching and short answers ✚ Avoid essay writing ✚ Time extension 	<ul style="list-style-type: none"> ❖ Prepare the exam using short sentences, multiple choices, true or false, matching and short answers if necessary. 	<ul style="list-style-type: none"> ✚ Use oral response as an option to give answer for trainees having severe upper limb impairment ✚ Time extension for trainees having severe upper limb impairment
Demonstration /Observation	<ul style="list-style-type: none"> ❖ Brief the instruction or provide them in large text 	<ul style="list-style-type: none"> ✚ Use sign language interpreter ✚ Brief on the instruction of the 	<ul style="list-style-type: none"> ✚ Provide activity based assessment ✚ Brief on the instruction of the exam 	<ul style="list-style-type: none"> ❖ Provide activity based assessment

	❖ Time extension	<ul style="list-style-type: none"> ⊕ Provide activity-based/ practical assessment method ⊕ Time extension 	<ul style="list-style-type: none"> ⊕ Use loud voice ⊕ Time extension 	<ul style="list-style-type: none"> ⊕ Conduct close follow up ⊕ Time extension
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ASSESSMENT CRITERIA:

LO1. Confirm drawing requirements

- Purpose, scope, information and presentation requirements for drawing are confirmed
- Review available information relevant to project and work requirements are identified and addressed further information needs
- Computing equipment and software used in the organization are identified.

LO2. Identify key features of CAD software

- Types of CAD software are described and used for detail drafting, their key features and suitability for producing specific drawing outcomes
- Differences in CAD process to generate 2-D drawings, 3-D models, and reasons for each presentation are identified
- CAD software used in the organization and confirms compatibility with other software programs and peripheral equipment are identified.

LO3. Create 2D drawings

- Drawings are created using the full capability of the available software system.
- Drawing entities are linked to database attributes to suit job requirements.
- Detailed views are created using various scales to meet job requirements.

LO4. Access software and set up for drawing work

- Open software and navigate organizational filing and library system
- Organizational and software templates are identified and determined uses
- Identify organizational symbols, codes and standards to be applied in drafting work and how these are accessed and applied

LO5. Produce basic drawing elements

- CAD functions to produce basic drawing elements are used
- Editing and transfer tools and methods to modify drawing elements are used
- Dimensions, text and symbols to drawing elements are applied
- Files are imported and exported into/out of working space
- Different views and perspectives are generated

LO6. Complete CAD operations

- Drawing elements are saved and filed according to organizational procedures
- Drawing elements are printed and evaluated presentations

Annex: Resource Requirements

IND MAC1 M02 0322 Performing CAD Operation				
Item No.	Category/Item	Description/ Specifications	Quantity	Recommended Ratio (Item: Trainee)
A.	Learning Materials			
1.	TTLM	TTTLM prepared by Trainer	25	1:1
2.	Reference Books	1.AutoCAD® 2009 2D Training Manual Written by Kristen S. Kurland Any additional book related to CAD 2. CAD/CAM/CIM 3 rd edition by P. Radhakrishnan S. Subramanian V. Raju	5	1:5
B.	Learning Facilities & Infrastructure			
1	Lecture Room	5*5m	1	1:25
2	Library	STD	1	1:25
3	Auto CAD Lab	Std	1	1:25
C.	Consumable Materials			
1.	Copy Paper	A4		1:1
2.	Ink	HP cartridge	1	1:25
3.	CAD Software	Updated	1	1:25
4.	CD	STD	3	1:10
D.	Tools and Equipment			
1.	Computer Desk top, laptop	Processor;i5-i7(4.5GHz RAM:8B-64GB Screen15.6inches Resolution FHD+(1920x1200) Storage256GB-2TB	25	1:1
2.	Projector	STD	1	1:25
3.	Photographic	STD	1	1:25

LEARNING MODULE 03	
TVET-PROGRAMME TITLE: Machining Level II	
MODULE TITLE : Maintaining Tools and Equipment	
MODULE CODE : <u>IND MAC2 M03 0322</u>	
NOMINAL DURATION : 50Hours	
MODULE DESCRIPTION : This Modules deals with the knowledge, skills and attitudes required in carrying out compulsory and routine safety and maintenance checks on machines and equipment, measuring instruments and tools in a manufacturing setting.	
<p>LEARNING OUTCOMES</p> <p>At the end of the module the trainee will be able to:</p> <p>LO1. Undertake program safety and maintenance checks</p> <p>LO2. Undertake basic program maintenance</p> <p>LO3. Perform basic preventive maintenance of tools</p> <p>LO4. Inventory tools and equipment</p>	
<p>MODULE CONTENTS:</p> <p>LO1. Undertake program safety and maintenance checks</p> <p>1.1. Inspecting and checking tools and machines/equipment.</p> <p>1.1.1. Manual, semi-automatic and automatic machines</p> <p>1.2. Undertaking checks safely and prescribe operational procedures.</p> <p>1.2.1 Programming safety and maintenance checks</p> <p>1.3. Checking and calibrating measuring instruments</p> <p>1.4. Segregating and labeling Non-functional tools, instruments and equipment.</p> <p>1.5. Recording Status/report on pro-forma or reporting orally.</p> <p>LO2. Undertake basic program maintenance</p> <p>2.1. Cleaning and lubricating machines equipment.</p> <p>2.2. Undertaking removal/replacement of consumable components.</p> <p>2.3. Replacing and/or topping up fluids and lubricants.</p> <p>2.4. Performing minor machine repairs.</p> <p>2.5. Adjusting machine moving parts.</p> <p>LO3. Perform basic preventive maintenance of tools</p> <p>3.1. Checking tools for defects/functionality.</p>	

- 3.1.1 Cutting tools - hacksaw, crosscut saw, rip saw
- 3.1.2 Boring tools - auger, brace, gimlet, hand drill
- 3.1.3 Holding tools - vice grip, C-clamp, bench vice
- 3.1.4 Threading tools - die and stock, taps
- 3.1.5 Measuring instruments-
- 3.1.6 Hand tools-Allen key hammer pairs

- 3.1. Reporting defective hand tools for repair or replacement.
- 3.2. Cleaning tools using appropriate cleaning materials.
- 3.3. Lubricating and storing tools.
- 3.4. Accomplishing necessary reports.

LO4. Inventory tools and equipment

- 4.1. Performing inventory of tools, instruments and equipment.
- 4.2. Documenting / recording inventory results.
- 4.3. Storing tools and equipment.

Learning Methods:				
For none impaired trainees	Reasonable Adjustment for Trainees with Disability (TWD)			
	Low Vision	Deaf	Hard of hearing	Physical impairment
Lecture discussion	<ul style="list-style-type: none"> ✚ Provide large print text ✚ Prepare the lecture in Audio/video ✚ Organize the class room seating arrangement to be accessible to trainees ✚ Write short notes on the black/white board using large text ✚ Make sure the luminosity of the light of class room is kept ✚ Use normal tone of voice ✚ Encourage trainees to record the lecture in audio format ✚ Provide Orientation on the physical feature of the work shop ✚ Summarize main points 	<ul style="list-style-type: none"> ✚ Assign sign language interpreter ✚ Arrange the class room seating to be conducive for eye to eye contact ✚ Make sure the luminosity of the light of class room is kept ✚ Introduce new and relevant vocabularies ✚ Use short and clear sentences ✚ Give emphasis on visual lecture and ensure the attention of the trainees ✚ Avoid movement during lecture time ✚ Present the lecture in video format 	<ul style="list-style-type: none"> ✚ Organize the class room seating arrangement to be accessible to trainees ✚ Speak loudly ✚ Ensure the attention of the trainees ✚ Present the lecture in video format ✚ Ensure the attention of the trainees 	<ul style="list-style-type: none"> ✚ Organize the class room seating arrangement to be accessible for wheelchairs users. ✚ Facilitate and support the trainees who have severe impairments on their upper limbs to take note ✚ Provide Orientation on the physical feature of the work shop

		❖ Summarize main points		
Demonstration	<ul style="list-style-type: none"> ✚ Conduct close follow up ✚ Use verbal description ✚ Provide special attention in the process of guidance ✚ facilitate the support of peer trainees ✚ Prepare & use simulation 	<ul style="list-style-type: none"> ✚ use Sign language interpreter ✚ Use video recorded material ✚ Ensure attention of the trainees ✚ Provide structured training ✚ Show clear and short method ✚ Use gesture ❖ provide tutorial support (if necessary) 	<ul style="list-style-type: none"> ✚ Illustrate in clear & short method ✚ Use Video recorded material ✚ Ensure the attention of the trainees ❖ provide tutorial support (if necessary) 	<ul style="list-style-type: none"> ✚ Facilitate and support the trainees having severe upper limbs impairment to operate equipment / machines ✚ Assign peer trainees to assist ✚ Conduct close follow up ❖ provide tutorial support (if necessary)
Group discussion	<ul style="list-style-type: none"> ✚ Facilitate the integration of trainees with group members ✚ Conduct close follow up ✚ Introduce the trainees with other group member ✚ Brief the thematic issues of the work 	<ul style="list-style-type: none"> ✚ Use sign language interpreters ✚ Facilitate the integration of trainees with group members ✚ Conduct close follow up ✚ Introduce the trainees with other group member 	<ul style="list-style-type: none"> ✚ Facilitate the integration of trainees with group members ✚ Conduct close follow up ✚ Introduce the trainees with other group member 	<ul style="list-style-type: none"> ❖ Introduce the trainees with their peers

			❖ Inform the group members to speak loudly	
Exercise	<ul style="list-style-type: none"> ✚ Conduct close follow up and guidance ✚ Provide tutorial support if necessary ✚ provide special attention in the process 	<ul style="list-style-type: none"> ✚ Conduct close follow up and guidance ✚ Provide tutorial support if necessary ✚ provide special attention in the process/practical training ✚ Introduce new and relevant vocabularies 	<ul style="list-style-type: none"> ✚ Conduct close follow up and guidance ✚ Provide tutorial support if necessary ✚ provide special attention in the process/ practical training 	<ul style="list-style-type: none"> ✚ Assign peer trainees ✚ Use additional nominal hours if necessary
Individual assignment	<ul style="list-style-type: none"> ✚ prepare the assignment questions in large text ✚ Encourage the trainees to prepare and submit the assignment in large texts ✚ Make available recorded assignment questions ✚ Facilitate the trainees to prepare and submit the assignment in soft or hard copy 	<ul style="list-style-type: none"> ✚ Use sign language interpreter ✚ Provide briefing /orientation on the assignment ✚ Provide visual recorded material 	<ul style="list-style-type: none"> ✚ Provide briefing /orientation on the assignment ✚ Provide visual recorded material 	

ASSESSMENT METHODS:				
Interview		<ul style="list-style-type: none"> ✚ Use sign language interpreter ✚ Ensure or conform whether the proper communication was conducted with the trainee through the service of the sign language interpreter ✚ Use short and clear questioning ✚ Time extension 	<ul style="list-style-type: none"> ✚ Speak loudly ✚ Using sign language interpreter if necessary 	<ul style="list-style-type: none"> ❖ Use written response as an option for the trainees having speech challenges
Written test	<ul style="list-style-type: none"> ✚ Prepare the exam in large texts ✚ Use interview as an option if necessary ✚ Prepare the exam in audio format ✚ Assign human reader (if necessary) ✚ Time extension 	<ul style="list-style-type: none"> ✚ Prepare the exam using short sentences, multiple choices, True or False, matching and short answers ✚ Avoid essay writing ✚ Time extension 	<ul style="list-style-type: none"> ❖ Prepare the exam using short sentences, multiple choices, true or false, matching and short answers if necessary. 	<ul style="list-style-type: none"> ✚ Use oral response as an option to give answer for trainees having severe upper limb impairment ✚ Time extension for trainees having severe upper limb impairment
Demonstration /Observation	<ul style="list-style-type: none"> ❖ Brief the instruction or provide them in large text 	<ul style="list-style-type: none"> ✚ Use sign language interpreter ✚ Brief on the instruction of the 	<ul style="list-style-type: none"> ✚ Provide activity based assessment ✚ Brief on the instruction of the exam 	<ul style="list-style-type: none"> ❖ Provide activity based assessment

	❖ Time extension	<ul style="list-style-type: none"> ⊕ Provide activity-based/ practical assessment method ⊕ Time extension 	<ul style="list-style-type: none"> ⊕ Use loud voice ⊕ Time extension 	<ul style="list-style-type: none"> ⊕ Conduct close follow up ⊕ Time extension
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ASSESSMENT CRITERIA:

LO1. Undertake program safety and maintenance checks

- Tools and machines/equipment are inspected/checked according to workplace routine
- Checks are undertaken safely and to prescribed operational procedures.
- Measuring instruments are checked and calibrated in accordance with manufacturer's instructions
- Non-functional tools, instruments and equipment are segregated and labeled according to classification
- Status/report is recorded on pro-forma or reported orally based on operational processes

LO2. Undertake basic program maintenance

- Machines/equipment are cleaned and lubricated using appropriate lubricant, according to preventive maintenance schedule or manufacturer's specifications/instructions following standard procedures
- Removal/replacement of consumable components is undertaken to prescribed procedure and instructions
- Fluids and lubricants are replaced and/or topped up to prescribed schedule and according to manufacturer's instructions
- Minor machine repairs performed according to manual instruction or workplace procedures
- Machine moving parts adjusted to manufacturer's specifications.

LO3. Perform basic preventive maintenance of tools

- Tools are checked for defects/functionality based on specifications
- Defective hand tools are reported for repair or replacement due to standard procedures
- Tools are cleaned using appropriate cleaning materials and according to standard procedures
- Tools are lubricated and stored according to prescribed procedures
- Necessary reports are accomplished in accordance with workplace

LO4. Inventory tools and equipment

- Inventory of tools, instruments and equipment is performed in accordance with workplace procedures
- Inventory results are documented / recorded in appropriate forms as per company regulations
- Tools and equipment are stored safely in appropriate locations in accordance with manufacturer's specifications or company policy

IND MAC1 M04 0322 Maintaining Tools and Equipment				
Item No.	Category/Item	Description/ Specifications	Quantity	Recommended Ratio (Item: Trainee)
A. Learning Materials				
1.	TTLM	TTTLM prepared by Trainer	25	1:1
2.	Reference Books	Lindley R. Higgins, R. Keith Mobley, Maintenance engineering handbook, Sixth Edition, Copyright © 2002 by The McGraw-Hill Companies.	5	1:5
B. Learning Facilities & Infrastructure				
1.	Lecture room / work shop	Standard	1	1:25
2.	Library	With sufficient books	1	1:25
C. Consumable Materials				
1.	Machine Grease	Kgs	5	1:5
2.	Rust remover (Wire brush)	Pcs	5	1:5
3.	Lubricants (Oil)	Lit	25	1:1
4.	Rugs	Kg	25	1:1
5.	Paper	A4	1 Pack	1:25
D. Tools and Equipment				
1.	Cutting tools - hacksaw, rip saw	Pcs		
2.	Boring tools - hand drill, Bench drill	Pcs		
3.	Holding tools - vice grip, C-clamp and bench vice	Standard	5 From Each	1:5
4.	Threading tools - die and tap stock	Standard		

5.	Measuring instruments-	Standard		
6.	Hand tools-Allen key hammer players	Standard		

LEARNING MODULE 04

TVET-PROGRAMME TITLE: **Machining Level II**

MODULE TITLE : **Performing Intermediate Lathe Operations**

MODULE CODE : **IND MAC2 M04 0322**

NOMINAL DURATION : **120 Hours**

MODULE DESCRIPTION : This Modules covers the knowledge, skills and attitudes required to setup work-piece to drawing specifications. It details the requirements for performing lathe operations considered as ‘intermediate’ such as turn, facing, taper turning, grooving, boring and machining components using chuck, cutting single and double start “v”& square thread (internal and external).and sketches, and applies to individuals working in the manufacturing industry.

LEARNING OUTCOMES

At the end of the module the trainee will be able to:

- LO1.** Determine job requirements
- LO2.** Set-up work piece
- LO3.** Perform lathe operations
- LO4.** Comply with Quality Assurance

MODULE CONTENTS:

LO1. Determine job requirements

- 1.1. Interpreting drawings.
- 1.2. Determining Sequence of operation.
- 1.3. Selecting cutting tools and work piece materials
 - 1.3.1 High speed steel for turning, facing, grooving, parting and thread cutting
 - 1.3.2 Inserts
 - 1.3.3 Drills
 - 1.3.4 Boring tool
 - 1.3.5 Knurling tools

LO2. Set-up work piece

- 2.1 Mounting and centering Work piece.
- 2.2 Setting up work piece using appropriate instruments/equipment
- 2.3 Applying safety precaution

LO3. Perform lathe operations

- 1.4. Calculating Speeds and feeds.

- 1.5. Calculating depth of thread cut and taper angle
- 1.6. Selecting lathe accessories
- 1.7. Performing lathe operations.
- 1.8. Calculating parameters
- 1.9. Applying OHS standards

LO4. Comply with Quality Assurance

- 4.1 Measuring tools and equipment
- 4.2 Checking techniques of work pieces
- 4.3 Handling deviations.

Learning Methods:				
For none impaired trainees	Reasonable Adjustment for Trainees with Disability (TWD)			
	Low Vision	Deaf	Hard of hearing	Physical impairment
Lecture discussion	<ul style="list-style-type: none"> ✚ Provide large print text ✚ Prepare the lecture in Audio/video ✚ Organize the class room seating arrangement to be accessible to trainees ✚ Write short notes on the black/white board using large text ✚ Make sure the luminosity of the light of class room is kept ✚ Use normal tone of voice ✚ Encourage trainees to record the lecture in audio format ✚ Provide Orientation on the physical feature of the work shop ✚ Summarize main points 	<ul style="list-style-type: none"> ✚ Assign sign language interpreter ✚ Arrange the class room seating to be conducive for eye to eye contact ✚ Make sure the luminosity of the light of class room is kept ✚ Introduce new and relevant vocabularies ✚ Use short and clear sentences ✚ Give emphasis on visual lecture and ensure the attention of the trainees ✚ Avoid movement during lecture time ✚ Present the lecture in video format 	<ul style="list-style-type: none"> ✚ Organize the class room seating arrangement to be accessible to trainees ✚ Speak loudly ✚ Ensure the attention of the trainees ✚ Present the lecture in video format ✚ Ensure the attention of the trainees 	<ul style="list-style-type: none"> ✚ Organize the class room seating arrangement to be accessible for wheelchairs users. ✚ Facilitate and support the trainees who have severe impairments on their upper limbs to take note ✚ Provide Orientation on the physical feature of the work shop

		❖ Summarize main points		
Demonstration	<ul style="list-style-type: none"> † Conduct close follow up † Use verbal description † Provide special attention in the process of guidance † facilitate the support of peer trainees † Prepare & use simulation 	<ul style="list-style-type: none"> † use Sign language interpreter † Use video recorded material † Ensure attention of the trainees † Provide structured training † Show clear and short method † Use gesture ❖ provide tutorial support (if necessary) 	<ul style="list-style-type: none"> † Illustrate in clear & short method † Use Video recorded material † Ensure the attention of the trainees ❖ provide tutorial support (if necessary) 	<ul style="list-style-type: none"> † Facilitate and support the trainees having severe upper limbs impairment to operate equipment / machines † Assign peer trainees to assist † Conduct close follow up ❖ provide tutorial support (if necessary)
Group discussion	<ul style="list-style-type: none"> † Facilitate the integration of trainees with group members † Conduct close follow up † Introduce the trainees with other group member † Brief the thematic issues of the work 	<ul style="list-style-type: none"> † Use sign language interpreters † Facilitate the integration of trainees with group members † Conduct close follow up † Introduce the trainees with other group member 	<ul style="list-style-type: none"> † Facilitate the integration of trainees with group members † Conduct close follow up † Introduce the trainees with other group member 	<ul style="list-style-type: none"> ❖ Introduce the trainees with their peers

			❖ Inform the group members to speak loudly	
Exercise	<ul style="list-style-type: none"> ✚ Conduct close follow up and guidance ✚ Provide tutorial support if necessary ✚ provide special attention in the process 	<ul style="list-style-type: none"> ✚ Conduct close follow up and guidance ✚ Provide tutorial support if necessary ✚ provide special attention in the process/practical training ✚ Introduce new and relevant vocabularies 	<ul style="list-style-type: none"> ✚ Conduct close follow up and guidance ✚ Provide tutorial support if necessary ✚ provide special attention in the process/ practical training 	<ul style="list-style-type: none"> ✚ Assign peer trainees ✚ Use additional nominal hours if necessary
Individual assignment	<ul style="list-style-type: none"> ✚ prepare the assignment questions in large text ✚ Encourage the trainees to prepare and submit the assignment in large texts ✚ Make available recorded assignment questions ✚ Facilitate the trainees to prepare and submit the assignment in soft or hard copy 	<ul style="list-style-type: none"> ✚ Use sign language interpreter ✚ Provide briefing /orientation on the assignment ✚ Provide visual recorded material 	<ul style="list-style-type: none"> ✚ Provide briefing /orientation on the assignment ✚ Provide visual recorded material 	

ASSESSMENT METHODS:				
Interview		<ul style="list-style-type: none"> ✚ Use sign language interpreter ✚ Ensure or conform whether the proper communication was conducted with the trainee through the service of the sign language interpreter ✚ Use short and clear questioning ✚ Time extension 	<ul style="list-style-type: none"> ✚ Speak loudly ✚ Using sign language interpreter if necessary 	<ul style="list-style-type: none"> ❖ Use written response as an option for the trainees having speech challenges
Written test	<ul style="list-style-type: none"> ✚ Prepare the exam in large texts ✚ Use interview as an option if necessary ✚ Prepare the exam in audio format ✚ Assign human reader (if necessary) ✚ Time extension 	<ul style="list-style-type: none"> ✚ Prepare the exam using short sentences, multiple choices, True or False, matching and short answers ✚ Avoid essay writing ✚ Time extension 	<ul style="list-style-type: none"> ❖ Prepare the exam using short sentences, multiple choices, true or false, matching and short answers if necessary. 	<ul style="list-style-type: none"> ✚ Use oral response as an option to give answer for trainees having severe upper limb impairment ✚ Time extension for trainees having severe upper limb impairment
Demonstration /Observation	<ul style="list-style-type: none"> ❖ Brief the instruction or provide them in large text 	<ul style="list-style-type: none"> ✚ Use sign language interpreter ✚ Brief on the instruction of the 	<ul style="list-style-type: none"> ✚ Provide activity based assessment ✚ Brief on the instruction of the exam 	<ul style="list-style-type: none"> ❖ Provide activity based assessment

	❖ Time extension	† Provide activity-based/ practical assessment method † Time extension	† Use loud voice † Time extension	† Conduct close follow up † Time extension
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ASSESSMENT CRITERIA:

LO.1 Determine job requirements

- Drawings are interpreted to produce component to specifications.
- Sequence of operation is determined to produce component to specifications.
- Cutting tools are selected according to the requirements of the operation

LO.2 Set-up work piece

- Work piece is mounted and centered on chuck to required level of accuracy using appropriate tools and equipment and in accordance with worksite procedures.
- Work piece is setup using appropriate instruments/equipment based on standard procedure.
- Setup operations are performed applying safety procedures and using personal protective devices due to OHS regulations

LO.3 Perform lathe operations

- Speeds and feeds are calculated using appropriate mathematical techniques and reference material according to standard
- Depth of thread cut and taper angle are calculated according to standard instructions
- Selected lathe accessories are used based on the requirements of the operation.
- Lathe operations are performed to produce component in compliance with specifications.
- Operations are performed applying knowledge on safety procedures and using personal protective devices due to OHS standards

LO.4 Comply with Quality Assurance

- Work piece is checked/measured using appropriate techniques, measuring tools and equipment in conformance with specification
- Work piece is checked in conformance with finished quality
- Deviations are handled appropriately in accordance with organization procedures and standard

Annex: Resource Requirements

IND MAC2 M04 0322 Performing Intermediate Lathe Operations				
Item No.	Category/Item	Description/ Specifications	Quantity	Recommended Ratio (Item: Trainee)
A. Learning Materials				
1.	TTLM	TTTLM prepared by Trainer	25	1:1
2.	Reference Books	Machining Process And Machining Tool Me305 Manufacturing Techniques Fall 2016/17 Week 10		
B. Learning Facilities & Infrastructure				
1.	Class room	Standard	1	1:25
2.	Clinic	Standard	1	1:25
3.	Workshop	Standard	1	1:25
4.	Library	Standard	1	1:25
C. Consumable Materials				
1.	Paper	A4 & A3	5 pack	1:5
2.	White board marker	Standard	1 pack	---
3.	Aluminum Ingot	Ø 30-100x500mm	1 each	25
4.	Mild steel Round bar	Ø20-60x6000mm	1 each	25
D. Tools and Equipment				
1.	Lathe tools, drill, reamers	Standard	Each set 5	5:25
2.	Different type Lathe machines	Standard	5	5:25
3.	Accessories (Chucks, Boring bar, Clamps, Vises, Angle Clamping devices, Chucks, vices, clamps) etc.	Standard	Each set	5:25
4.	Personal protective equipment's	Standard	25	1:1
5.	Meter tape	3 meter & 5 meter	25	1:1
6.	Steel rule	30,50,60 and 100mm	25	1:1
7.	Try square	450 x900	25	1:1
8.	Steel rule	300 x600	25	1:1
9.	Vernier caliper	0.02,0.05 and 0.1mm	5	5:25
10.	Micrometer	0-25, 25-50, 50-75 and 75-100mm	5	5:25

LEARNING MODULE 05	
TVET-PROGRAMME TITLE: Machining Level II	
MODULE TITLE: Performing Intermediate Milling Operations	
MODULE CODE: <u>IND MAC2 M05 0322</u>	
NOMINAL DURATION: .100 Hours	
MODULE DESCRIPTION: This Module covers the knowledge, skills and attitudes required to set-up and mill work-piece according to the drawing. It details the requirements for performing milling operations considered as “intermediate” such as indexing, milling splines and equally-spaced grooves, 45 serrations in cylindrical work –piece and rack, ratchets, converging faces, large radial slots and internal radii	
<p>LEARNING OUTCOMES</p> <p>At the end of the module the trainee will be able to:</p> <ul style="list-style-type: none"> LO1. Determine job requirements LO2. Set-up work piece LO3. Perform milling operations LO4. Check/ measure work piece 	
<p>MODULE CONTENTS:</p> <p>LO1. Determine job requirements</p> <ul style="list-style-type: none"> 2.1 Interpreting drawings. 2.2 Determining sequence of operation. 2.3 Selecting cutting tools. <ul style="list-style-type: none"> 2.3.1 Side and face cutters 2.3.2 Gear cutter and other formed cutter 2.3.3 Slitting cutter 2.3.4 End mills and Drill bit 2.3.5 Shell end mills 2.3.6 T-slots and Dovetail cutters <p>LO2. Set-up work piece</p> <ul style="list-style-type: none"> 2.1 Setting up work piece . 2.2 Applying safety procedures. 2.3 Ensuring setup to be safe with compliance to work operation. 	

LO3.Perform milling operations

- 3.1 Calculating speeds and feeds.
- 3.2 Making appropriate milling machine accessories.
- 3.3 Performing milling operations.
 - 3.3.1 Work holding devices
 - 3.3.2 Indexing head
 - 3.3.3 Footstock
 - 3.3.4 Slotting attachment
 - 3.3.5 Rotary table
- 3.4 Performing milling operations on safety procedures
 - 3.4.1 Indexing
 - 3.4.2 Straddle-milling
 - 3.4.3 Milling splines
 - 3.4.4 Milling ratchet
 - 3.4.5 Milling converging faces
 - 3.4.6 Milling large radial slots

LO4.Check/ measure work piece

- 1.1 Checking/measuring work piece
- 1.2 Handling deviations.

Learning Methods:				
For none impaired trainees	Reasonable Adjustment for Trainees with Disability (TWD)			
	Low Vision	Deaf	Hard of hearing	Physical impairment
Lecture discussion	<ul style="list-style-type: none"> ✚ Provide large print text ✚ Prepare the lecture in Audio/video ✚ Organize the class room seating arrangement to be accessible to trainees ✚ Write short notes on the black/white board using large text ✚ Make sure the luminosity of the light of class room is kept ✚ Use normal tone of voice ✚ Encourage trainees to record the lecture in audio format ✚ Provide Orientation on the physical feature of the work shop ✚ Summarize main points 	<ul style="list-style-type: none"> ✚ Assign sign language interpreter ✚ Arrange the class room seating to be conducive for eye to eye contact ✚ Make sure the luminosity of the light of class room is kept ✚ Introduce new and relevant vocabularies ✚ Use short and clear sentences ✚ Give emphasis on visual lecture and ensure the attention of the trainees ✚ Avoid movement during lecture time ✚ Present the lecture in video format 	<ul style="list-style-type: none"> ✚ Organize the class room seating arrangement to be accessible to trainees ✚ Speak loudly ✚ Ensure the attention of the trainees ✚ Present the lecture in video format ✚ Ensure the attention of the trainees 	<ul style="list-style-type: none"> ✚ Organize the class room seating arrangement to be accessible for wheelchairs users. ✚ Facilitate and support the trainees who have severe impairments on their upper limbs to take note ✚ Provide Orientation on the physical feature of the work shop

		❖ Summarize main points		
Demonstration	<ul style="list-style-type: none"> † Conduct close follow up † Use verbal description † Provide special attention in the process of guidance † facilitate the support of peer trainees † Prepare & use simulation 	<ul style="list-style-type: none"> † use Sign language interpreter † Use video recorded material † Ensure attention of the trainees † Provide structured training † Show clear and short method † Use gesture ❖ provide tutorial support (if necessary) 	<ul style="list-style-type: none"> † Illustrate in clear & short method † Use Video recorded material † Ensure the attention of the trainees ❖ provide tutorial support (if necessary) 	<ul style="list-style-type: none"> † Facilitate and support the trainees having severe upper limbs impairment to operate equipment / machines † Assign peer trainees to assist † Conduct close follow up ❖ provide tutorial support (if necessary)

<p>Group discussion</p>	<ul style="list-style-type: none"> ✚ Facilitate the integration of trainees with group members ✚ Conduct close follow up ✚ Introduce the trainees with other group member ✚ Brief the thematic issues of the work 	<ul style="list-style-type: none"> ✚ Use sign language interpreters ✚ Facilitate the integration of trainees with group members ✚ Conduct close follow up ✚ Introduce the trainees with other group member 	<ul style="list-style-type: none"> ✚ Facilitate the integration of trainees with group members ✚ Conduct close follow up ✚ Introduce the trainees with other group member 	<ul style="list-style-type: none"> ❖ Introduce the trainees with their peers
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			❖ Inform the group members to speak loudly	
Exercise	<ul style="list-style-type: none"> ✚ Conduct close follow up and guidance ✚ Provide tutorial support if necessary ✚ provide special attention in the process 	<ul style="list-style-type: none"> ✚ Conduct close follow up and guidance ✚ Provide tutorial support if necessary ✚ provide special attention in the process/practical training ✚ Introduce new and relevant vocabularies 	<ul style="list-style-type: none"> ✚ Conduct close follow up and guidance ✚ Provide tutorial support if necessary ✚ provide special attention in the process/ practical training 	<ul style="list-style-type: none"> ✚ Assign peer trainees ✚ Use additional nominal hours if necessary
Individual assignment	<ul style="list-style-type: none"> ✚ prepare the assignment questions in large text ✚ Encourage the trainees to prepare and submit the assignment in large texts ✚ Make available recorded assignment questions ✚ Facilitate the trainees to prepare and submit the assignment in soft or 	<ul style="list-style-type: none"> ✚ Use sign language interpreter ✚ Provide briefing /orientation on the assignment ✚ Provide visual recorded material 	<ul style="list-style-type: none"> ✚ Provide briefing /orientation on the assignment ✚ Provide visual recorded material 	

	hard copy			
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ASSESSMENT METHODS:				
Interview		<ul style="list-style-type: none"> † Use sign language interpreter † Ensure or conform whether the proper communication was conducted with the trainee through the service of the sign language interpreter † Use short and clear questioning † Time extension 	<ul style="list-style-type: none"> † Speak loudly † Using sign language interpreter if necessary 	<ul style="list-style-type: none"> ❖ Use written response as an option for the trainees having speech challenges
Written test	<ul style="list-style-type: none"> † Prepare the exam in large texts † Use interview as an option if necessary † Prepare the exam in audio format † Assign human reader (if necessary) † Time extension 	<ul style="list-style-type: none"> † Prepare the exam using short sentences, multiple choices, True or False, matching and short answers † Avoid essay writing † Time extension 	<ul style="list-style-type: none"> ❖ Prepare the exam using short sentences, multiple choices, true or false, matching and short answers if necessary. 	<ul style="list-style-type: none"> † Use oral response as an option to give answer for trainees having severe upper limb impairment † Time extension for trainees having severe upper limb impairment
Demonstration /Observation	<ul style="list-style-type: none"> ❖ Brief the instruction or provide them in large 	<ul style="list-style-type: none"> † Use sign language interpreter † Brief on the instruction of the 	<ul style="list-style-type: none"> † Provide activity based assessment 	<ul style="list-style-type: none"> ❖ Provide activity based assessment

	text		† Brief on the instruction of the exam	
	❖ Time extension	† Provide activity-based/ practical assessment method † Time extension	† Use loud voice † Time extension	† Conduct close follow up † Time extension

ASSESSMENT CRITERIA:

LO.1.Determine job requirements

- Drawings are interpreted to produce component to specifications.
- Sequence of operation is determined to produce component to specifications.
- Cutting tools are selected according to the requirements of the operational standards

LO.2 Set-up work piece

- Work piece is setup to required level of accuracy using appropriate instruments/equipment and in accordance with standard procedures.
- Setup operations are performed applying safety procedures and using personal protective devices based on OHS
- Setup is ensured to be safe with compliance to work operation..

LO.3. Perform milling operations

- Speeds and feeds are calculated using appropriate mathematical techniques and reference material based on standards.
- Milling machine accessories used are made appropriate to the requirements of the operational standards.
- Milling operations are performed to produce component inclusive gears to specifications.
- Milling operations are performed applying knowledge on safety procedures and using personal protective devices based on OHS.

LO.4 Check/ measure work piece

- Work piece is checked/measured using appropriate techniques, measuring tools and equipment in conformance to specification
- Work piece is checked in conformance with finished quality
- Deviations are handled appropriately in accordance with organization procedures and standard

Annex: Resource Requirements

IND MAC2 M05 0322 Performing Inter mediate Milling Operations				
Item No.	Category/Item	Description/ Specifications	Quantity	Recommended Ratio (Item: Trainee)
A. Learning Materials				
1.	TTLM	TTTLM prepared by the trainer	25	1:1
2.	Reference Books	<ul style="list-style-type: none"> Modern Machining Technology Operation Apractical Guide Eddited By J Paulo David. Metal Cutting Principles Second Edition Milton C. Shaw 	5	1:5
3.	Journals/Publication/Magazines	Latest Edition Related To The Subject	5	1:5
B. Learning Facilities & Infrastructure				
1.	Drawing Room	Standard	1	1:25
2.	Clinic	Standard	1	1:25
C. Consumable Materials				
3.	Copy paper Drawing paper	A ₄ , ,	5packs	1:5
4.	Aluminum bar	500mmx ø 100mm	25pcs	1:1
5.	Aluminum bar	500mmx ø 50mm	25pcs	1:1
6.	Aluminum bar	500mmx ø 40mm	25pcs	1:1
7.	White Board Marker	Standard	1 pack	
8.	Mild steel round bar	6000mmx ø 100mm	25 pcs	1:1
9.	Mild steel round bar	6000mmx ø 70mm	1 pcs	1;5
10.	Mild steel round bar	6000mmx ø 50mm	1 pcs	1:5
11.	Mild steel round bar	6000mmx ø 30mm	2 pcs	

12.	Mild steel round bar	6000mmx ø 20mm	2 pcs	
13.	Mild steel round bar	6000mmx ø 12mm	2 pcs	
14.	Different Power Hacksaw blade	Sweden	25 pcs	1:1
15.	Drill bit(different size)	Set ø1-13	2 pcs	2:25
16.	Grinder wheel disc	set	2 pcs	2:25
D Tools and Equipment				
1.	End mill Cutter HSS (different size)	Standard	25	1:1
2.	White Board	Standard	1	1:25
3.	Plan mill cutter (different size)	Standard	25	1:1
4.	Files (different types)	Standard	5 pcs	5 pcs
5.	Divider	45 ⁰ X 90 ⁰	5 pcs	5 pcs
6.	Tape rule	30 ⁰ X 60 ⁰		
7.	Gages (different types)	Standard	5 pcs	5 pcs
8.	Steel rule	Standard	5 pcs	5 pcs
9.	Try square	Standard	25 pcs	25 pcs
10.	LCD	Standard	1	1:25
11.	Scriber	Standard	25 pcs	1:1
12.	Bevel protractor	Standard	5 pcs	1:5
13.	C- clamp	Standard	5 pcs	1:5
14.	Bench vise	Standard	25 pcs	1:1
15.	Height gauge	Standard	2 pcs	2:25
16.	Surface plate	Standard	2 pcs	2:25
17.	Angle plate	Standard	2 pcs	2:25
18.	Vernier caliper	Standard	5 pcs	1:5
19.	Vernier height gauge	Standard	2 pcs	2:25
20.	Micrometers	Standard	5 pcs	1:5
21.	Drill Press	Standard	2 pcs	2:25
22.	Machine vise	Standard	5 pcs	5:25

23	Angle plate	Standard	4 pcs	4:25
24	Universal machine vice	Standard	3 pcs	3:25
25	Portable electric hand grinder	Standard	2 pcs	2:25
26	Work bench	Standard	7 pcs	7:25
27	Knurling tools	Medium size	2 pcs	2:25
28	Dividing head / Indexing head with assessors	Standard	2 pcs	2:25
28	Side and face cutters	Standard	5	1:5
29	Gear cutter and other formed cutter	Standard	5	1:5
30	Slitting cutter	Standard	5	1:5
31	End mills and Drill bit	Standard	5	1:5
32	Shell end mills	Standard	5	1:5
33	T-slots and Dovetail cutters	Standard	5	1:5
34	Counter Sink and counter bore Tool	Standard	5	1:5
35	Collate	Different size	5	1:5
36	Sleeve	Standard	5	1:5
42 37	Horizontal milling machine	Standard	5pcs	5:25
38	Universals milling machine	Standard	5 pcs	5:25

LEARNING MODULE 06	
TVET-PROGRAMME TITLE: Machining Level II	
MODULE TITLE : Performing Intermediate Grinding Operations	
MODULE CODE : IND MAC2 06 0222	
NOMINAL DURATION : 60 Hours	
MODULE DESCRIPTION : This module covers the knowledge, skills and attitudes needed to perform intermediate grinding operations conforming to the required specifications.	
<p>LEARNING OUTCOMES</p> <p>At the end of the module the trainee will be able to:</p> <p>LO1. Set up work</p> <p>LO2. Perform intermediate grinding operations</p> <p>LO3. Quality assure components in conformance to specifications</p>	
<p>MODULE CONTENTS:</p> <p>LO1. Set up work</p> <p>1.1 Determining work requirements and sequence of operations</p> <p>1.1.1 Dimensions and tolerances,</p> <p>1.1.2 Geometry</p> <p>1.1.3 Surface finish</p> <p>1.2 Selecting tool and cutter grinding wheels and balanced.</p> <p>1.2.1 Static</p> <p>1.2.2 Dynamic balancing.</p> <p>1.3 Selecting and applying appropriate work holding devices</p> <p>1.4 Selecting, balancing and dressing grinding wheels</p> <p>1.5 Selecting accessories to facilitate production.</p> <p>LO2. Perform intermediate grinding operations</p> <p>2.1. Setting up and adjusting grinding machines</p> <p>2.1.1. Surface, cylindrical and eccentric grinding machines</p> <p>2.2 Performing grinding work procedures.</p> <p>2.3 Performing grinding operations</p> <p>2.4 Observing OHS measures and procedure.</p> <p>LO3. Quality assure components in conformance to specifications</p> <p>3.1 Checking components</p>	

3.2 Determining the required grade of tolerance

Learning Methods:				
For none impaired trainees	Reasonable Adjustment for Trainees with Disability (TWD)			
	Low Vision	Deaf	Hard of hearing	Physical impairment
Lecture discussion	<ul style="list-style-type: none"> ✚ Provide large print text ✚ Prepare the lecture in Audio/video ✚ Organize the class room seating arrangement to be accessible to trainees ✚ Write short notes on the black/white board using large text ✚ Make sure the luminosity of the light of class room is kept ✚ Use normal tone of voice ✚ Encourage trainees to record the lecture in audio format ✚ Provide Orientation on the physical feature of the work shop ✚ Summarize main points 	<ul style="list-style-type: none"> ✚ Assign sign language interpreter ✚ Arrange the class room seating to be conducive for eye to eye contact ✚ Make sure the luminosity of the light of class room is kept ✚ Introduce new and relevant vocabularies ✚ Use short and clear sentences ✚ Give emphasis on visual lecture and ensure the attention of the trainees ✚ Avoid movement during lecture time ✚ Present the lecture in video format 	<ul style="list-style-type: none"> ✚ Organize the class room seating arrangement to be accessible to trainees ✚ Speak loudly ✚ Ensure the attention of the trainees ✚ Present the lecture in video format ✚ Ensure the attention of the trainees 	<ul style="list-style-type: none"> ✚ Organize the class room seating arrangement to be accessible for wheelchairs users. ✚ Facilitate and support the trainees who have severe impairments on their upper limbs to take note ✚ Provide Orientation on the physical feature of the work shop

		❖ Summarize main points		
Demonstration	<ul style="list-style-type: none"> ✚ Conduct close follow up ✚ Use verbal description ✚ Provide special attention in the process of guidance ✚ facilitate the support of peer trainees ✚ Prepare & use simulation 	<ul style="list-style-type: none"> ✚ use Sign language interpreter ✚ Use video recorded material ✚ Ensure attention of the trainees ✚ Provide structured training ✚ Show clear and short method ✚ Use gesture ❖ provide tutorial support (if necessary) 	<ul style="list-style-type: none"> ✚ Illustrate in clear & short method ✚ Use Video recorded material ✚ Ensure the attention of the trainees ❖ provide tutorial support (if necessary) 	<ul style="list-style-type: none"> ✚ Facilitate and support the trainees having severe upper limbs impairment to operate equipment / machines ✚ Assign peer trainees to assist ✚ Conduct close follow up ❖ provide tutorial support (if necessary)
Group discussion	<ul style="list-style-type: none"> ✚ Facilitate the integration of trainees with group members ✚ Conduct close follow up ✚ Introduce the trainees with other group member ✚ Brief the thematic issues of the work 	<ul style="list-style-type: none"> ✚ Use sign language interpreters ✚ Facilitate the integration of trainees with group members ✚ Conduct close follow up ✚ Introduce the trainees with other group member 	<ul style="list-style-type: none"> ✚ Facilitate the integration of trainees with group members ✚ Conduct close follow up ✚ Introduce the trainees with other group member 	<ul style="list-style-type: none"> ❖ Introduce the trainees with their peers

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			❖ Inform the group members to speak loudly	
Exercise	<ul style="list-style-type: none"> ✚ Conduct close follow up and guidance ✚ Provide tutorial support if necessary ✚ provide special attention in the process 	<ul style="list-style-type: none"> ✚ Conduct close follow up and guidance ✚ Provide tutorial support if necessary ✚ provide special attention in the process/practical training ✚ Introduce new and relevant vocabularies 	<ul style="list-style-type: none"> ✚ Conduct close follow up and guidance ✚ Provide tutorial support if necessary ✚ provide special attention in the process/ practical training 	<ul style="list-style-type: none"> ✚ Assign peer trainees ✚ Use additional nominal hours if necessary
Individual assignment	<ul style="list-style-type: none"> ✚ prepare the assignment questions in large text ✚ Encourage the trainees to prepare and submit the assignment in large texts ✚ Make available recorded assignment questions ✚ Facilitate the trainees to prepare and submit the assignment in soft or 	<ul style="list-style-type: none"> ✚ Use sign language interpreter ✚ Provide briefing /orientation on the assignment ✚ Provide visual recorded material 	<ul style="list-style-type: none"> ✚ Provide briefing /orientation on the assignment ✚ Provide visual recorded material 	

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ASSESSMENT METHODS:				
Interview		<ul style="list-style-type: none"> † Use sign language interpreter † Ensure or conform whether the proper communication was conducted with the trainee through the service of the sign language interpreter † Use short and clear questioning † Time extension 	<ul style="list-style-type: none"> † Speak loudly † Using sign language interpreter if necessary 	<ul style="list-style-type: none"> ❖ Use written response as an option for the trainees having speech challenges
Written test	<ul style="list-style-type: none"> † Prepare the exam in large texts † Use interview as an option if necessary † Prepare the exam in audio format † Assign human reader (if necessary) † Time extension 	<ul style="list-style-type: none"> † Prepare the exam using short sentences, multiple choices, True or False, matching and short answers † Avoid essay writing † Time extension 	<ul style="list-style-type: none"> ❖ Prepare the exam using short sentences, multiple choices, true or false, matching and short answers if necessary. 	<ul style="list-style-type: none"> † Use oral response as an option to give answer for trainees having severe upper limb impairment † Time extension for trainees having severe upper limb impairment

Demonstration /Observation	❖ Brief the instruction or provide them in large text	✚ Use sign language interpreter ✚ Brief on the instruction of the	✚ Provide activity based assessment ✚ Brief on the instruction of the exam	❖ Provide activity based assessment
	❖ Time extension	✚ Provide activity-based/ practical assessment method ✚ Time extension	✚ Use loud voice ✚ Time extension	✚ Conduct close follow up ✚ Time extension

ASSESSMENT CRITERIA:

LO1. Set up work

- Work requirements and sequence of operations are determined from specifications and according to standard procedures accordingly
- Tool and cutter grinding wheels are selected, based on knowledge of discs and grinding agents, and are balanced and dressed according to operational standards
- Correct and appropriate work holding devices are selected and applied in accordance to appropriate machine device.
- Grinding wheels are selected, balanced and dressed to form and size based on standard requirements
- Accessories are selected to facilitate production to task specifications.

LO2. Perform intermediate grinding operations

- Grinding machines are set up and adjusted in accordance with defined procedures
- Grinding work is performed safely, utilizing all guards, safety procedures and personal protective clothing and equipment based on OHS
- Grinding operations are performed in accordance with operational standards
- OHS measures and procedures are observed throughout the machining operations

LO3. Quality assure components in conformance to specifications

- Components are checked using standard techniques, tools and equipment
- Required grade of tolerance is determined based on drawing and work standards

Annex: Resource Requirements

IND MAC2 M06 0322 Performing Intermediate Grinding Operations				
Item No.	Category/Item	Description/ Specifications	Quantity	Recommended Ratio (Item: Trainee)
A. Learning Materials				
1.	TTLM	TTTLM prepared by Trainer	25	1:1
2.	Reference Books	El – Hoffy Advance Machining Process, Mc Graw Hill Companies, 0.007- 1466940, 2005	5	1:5
B. Learning Facilities & Infrastructure				
1.	Lecture Room	Standard	25	1:1
2.	Library	Standard	25	1:1
3.	Work shop	Standard		
C. Consumable Materials				
1.	Paper	A4	1pac.	1:5
2	Wheel	STD	10	1:10
3	Machine coolant	litter	5	1:5
4	Mild steel/round bar	Ø20x6000mm	1	1:25
5	Cutter different size		5	1:5
D. Tools and equipment				
1	Wheel dresser	STD	1	1:25
2	Wheel balance	STD	1	1:25
3	Vices	STD	5	1:5
4	Clamps	STD	5	1:5
5	Magnetic chuck	STD	5	1:5
6	Face plates	STD	5	1:5
7	Collects	STD	5	1:5
8	¾ jaw chuck and adapters	STD	5	1:5
9	End mill	Ø6	5	1:5
10	Form module milling cutters	set Ø22	1	1:25

11	Flat, vee and circular form tools and hobs	Ø22	5	1:5
12	Slitting saws	Ø22	5	1:5
13	Drills	Ø20	5	1:5
14	Boring and parting/grooving tools	STD	5	1:5
15	Thread cutting tools	STD	5	1:5

LEARNING MODULE 07	
TVET-PROGRAMME TITLE: Machining Level II	
MODULE TITLE : Performing machining operations using horizontal and vertical boring	
MODULE CODE : IND MAC2 M07 03 22	
NOMINAL DURATION : 60 Hours	
MODULE DESCRIPTION :This Modules deals the knowledge, skills and attitudes required to effectively perform machining operations using horizontal and/or vertical boring machine as applies to individuals working in the metal engineering and maintenance industry	
<p>LEARNING OUTCOMES</p> <p>At the end of the module the trainee will be able to:</p> <p>LO1. Determine job requirements</p> <p>LO2. Set up work.</p> <p>LO3. Perform boring operations.</p> <p>LO4. Check component for conformance to specification.</p> <p>LO5. Identify inserts from standards</p> <p>LO6. Adjust and maintain machine</p> <p>LO7. Clean up</p>	
<p>MODULE CONTENTS:</p> <p>LO1. Determine job requirements</p> <p>1.1.Interpreting drawings to produce component.</p> <p>1.2.Determining Sequence of operations and selecting tools.</p> <p>1.3.Determining cutting parameters.</p> <p>LO2. Set up work.</p> <p>2.1. Setting up work.</p> <p>2.2.Completing holding of the part to be bored using standards machine.</p> <p>LO3. Perform boring operations.</p> <p>3.1. Carrying out horizontal and vertical boring operation.</p> <p>3.2. Measuring size of the holes of the bored materials.</p> <p>3.3. Carrying out taper boring.</p> <p>3.4. Checking work for accuracy against pre-determined parameters</p>	

L04. Check component for conformance to specification.

- 4.1 Checking components for conformance.
- 4.2 Checking components for accuracy.
- 4.3 Making adjustments to ensure accuracy and quality of outcome

L05. Identify inserts from standards

- 5.1 Making adjustments to ensure accuracy and quality of outcome.
- 5.2 Selecting correct tool using International Standard.

L06. Adjust and maintain machine

- 6.1 Carrying out routine maintenance and adjustments.
- 6.2 Checking machines.
- 6.3 Observing Correct OHS

L07. Clean up

- 7.1 Stacking /storing materials.
- 7.2 Clearing work area.
- 7.3 Cleaning, maintaining and storing tools and equipment.

Learning Methods:				
For none impaired trainees	Reasonable Adjustment for Trainees with Disability (TWD)			
	Low Vision	Deaf	Hard of hearing	Physical impairment
Lecture discussion	<ul style="list-style-type: none"> ✚ Provide large print text ✚ Prepare the lecture in Audio/video ✚ Organize the class room seating arrangement to be accessible to trainees ✚ Write short notes on the black/white board using large text ✚ Make sure the luminosity of the light of class room is kept ✚ Use normal tone of voice ✚ Encourage trainees to record the lecture in audio format ✚ Provide Orientation on the physical feature of the work shop ✚ Summarize main points 	<ul style="list-style-type: none"> ✚ Assign sign language interpreter ✚ Arrange the class room seating to be conducive for eye to eye contact ✚ Make sure the luminosity of the light of class room is kept ✚ Introduce new and relevant vocabularies ✚ Use short and clear sentences ✚ Give emphasis on visual lecture and ensure the attention of the trainees ✚ Avoid movement during lecture time ✚ Present the lecture in video format 	<ul style="list-style-type: none"> ✚ Organize the class room seating arrangement to be accessible to trainees ✚ Speak loudly ✚ Ensure the attention of the trainees ✚ Present the lecture in video format ✚ Ensure the attention of the trainees 	<ul style="list-style-type: none"> ✚ Organize the class room seating arrangement to be accessible for wheelchairs users. ✚ Facilitate and support the trainees who have severe impairments on their upper limbs to take note ✚ Provide Orientation on the physical feature of the work shop

		❖ Summarize main points		
Demonstration	<ul style="list-style-type: none"> ✚ Conduct close follow up ✚ Use verbal description ✚ Provide special attention in the process of guidance ✚ facilitate the support of peer trainees ✚ Prepare & use simulation 	<ul style="list-style-type: none"> ✚ use Sign language interpreter ✚ Use video recorded material ✚ Ensure attention of the trainees ✚ Provide structured training ✚ Show clear and short method ✚ Use gesture ❖ provide tutorial support (if necessary) 	<ul style="list-style-type: none"> ✚ Illustrate in clear & short method ✚ Use Video recorded material ✚ Ensure the attention of the trainees ❖ provide tutorial support (if necessary) 	<ul style="list-style-type: none"> ✚ Facilitate and support the trainees having severe upper limbs impairment to operate equipment / machines ✚ Assign peer trainees to assist ✚ Conduct close follow up ❖ provide tutorial support (if necessary)
Group discussion	<ul style="list-style-type: none"> ✚ Facilitate the integration of trainees with group members ✚ Conduct close follow up ✚ Introduce the trainees with other group member ✚ Brief the thematic issues of the work 	<ul style="list-style-type: none"> ✚ Use sign language interpreters ✚ Facilitate the integration of trainees with group members ✚ Conduct close follow up ✚ Introduce the trainees with other group member 	<ul style="list-style-type: none"> ✚ Facilitate the integration of trainees with group members ✚ Conduct close follow up ✚ Introduce the trainees with other group member 	<ul style="list-style-type: none"> ❖ Introduce the trainees with their peers

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			❖ Inform the group members to speak loudly	
Exercise	<ul style="list-style-type: none"> ✚ Conduct close follow up and guidance ✚ Provide tutorial support if necessary ✚ provide special attention in the process 	<ul style="list-style-type: none"> ✚ Conduct close follow up and guidance ✚ Provide tutorial support if necessary ✚ provide special attention in the process/practical training ✚ Introduce new and relevant vocabularies 	<ul style="list-style-type: none"> ✚ Conduct close follow up and guidance ✚ Provide tutorial support if necessary ✚ provide special attention in the process/ practical training 	<ul style="list-style-type: none"> ✚ Assign peer trainees ✚ Use additional nominal hours if necessary
Individual assignment	<ul style="list-style-type: none"> ✚ prepare the assignment questions in large text ✚ Encourage the trainees to prepare and submit the assignment in large texts ✚ Make available recorded assignment questions ✚ Facilitate the trainees to prepare and submit the assignment in soft or 	<ul style="list-style-type: none"> ✚ Use sign language interpreter ✚ Provide briefing /orientation on the assignment ✚ Provide visual recorded material 	<ul style="list-style-type: none"> ✚ Provide briefing /orientation on the assignment ✚ Provide visual recorded material 	

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ASSESSMENT METHODS:				
Interview		<ul style="list-style-type: none"> † Use sign language interpreter † Ensure or conform whether the proper communication was conducted with the trainee through the service of the sign language interpreter † Use short and clear questioning † Time extension 	<ul style="list-style-type: none"> † Speak loudly † Using sign language interpreter if necessary 	<ul style="list-style-type: none"> ❖ Use written response as an option for the trainees having speech challenges
Written test	<ul style="list-style-type: none"> † Prepare the exam in large texts † Use interview as an option if necessary † Prepare the exam in audio format † Assign human reader (if necessary) † Time extension 	<ul style="list-style-type: none"> † Prepare the exam using short sentences, multiple choices, True or False, matching and short answers † Avoid essay writing † Time extension 	<ul style="list-style-type: none"> ❖ Prepare the exam using short sentences, multiple choices, true or false, matching and short answers if necessary. 	<ul style="list-style-type: none"> † Use oral response as an option to give answer for trainees having severe upper limb impairment † Time extension for trainees having severe upper limb impairment

Demonstration /Observation	❖ Brief the instruction or provide them in large text	⚡ Use sign language interpreter ⚡ Brief on the instruction of the	⚡ Provide activity based assessment ⚡ Brief on the instruction of the exam	❖ Provide activity based assessment
	❖ Time extension	⚡ Provide activity-based/ practical assessment method ⚡ Time extension	⚡ Use loud voice ⚡ Time extension	⚡ Conduct close follow up ⚡ Time extension

ASSESSMENT CRITERIA:

LO1. Determine job requirements

- Drawings are interpreted to produce component to specification using International Standard Organization or standard operating procedures.
- Sequence of operations is determined and tools are selected to produce component to specification using International Standard Organization or standard operating procedures.
- Cutting parameters are determined.

LO2. Set up work.

- Work is set up to required level of accuracy using instruments such as dial test indicators and sine bars
- Setup for boring in the lathe is completed using standards machine shop operations principles
- Holding of the part to be bored is completed using standards machine shop operations principles

LO3. Perform boring operations.

- Horizontal and vertical boring operation are carried out
- Size of holes bored is measured using standards machine shop operations principles.
- Taper boring is carried out to drawing specifications.
- Work is checked for accuracy against pre-determined parameters

LO4. Check component for conformance to specification.

- Components checked for conformance to specification using appropriate techniques, tools and equipment.
- Components are checked for accuracy against pre-determined parameters
- Adjustments are made to ensure accuracy and quality of outcome

LO5. Identify inserts from standards

- Adjustments are made to ensure accuracy and quality of outcome
- Correct tool is selected using International Standard and or Organization standards to suit cutting parameters

LO6. Adjust and maintain machine

- Routine maintenance and adjustments are carried out as required.
- Adjustments are carried out so as to maintain integrity of machine
- Machines are checked according to specifications
- Correct safety procedures are observed and protective clothing and safety glasses worn

L07. Clean up

- Materials are stacked/stored for re-use or disposed of.
- Work area is cleared.
- Tools and equipment are cleaned, maintained and stored

Annex: Resource Requirements

IND MAC2 M07 0322 Performing machining Operations using horizontal and vertical boring machine				
Item No.	Category/Item	Description/ Specifications	Quantity	Recommended Ratio (Item: Trainee)
A. Learning Materials				
1.	TTLM	TTTLM prepared by Trainer	25	1:1
2.	Reference Books	B. H. Amstead, P. Ostwald, M.L.Begaman, Manufacturing Processes,(8 Edition	5	1:5
B. Learning Facilities & Infrastructure				
5.	Lecture room / work shop	Standard	1	1:25
6.	Library	With sufficient books	1	1:25
C. Consumable Materials				
1.	Machine Grease	Kgs	5	1:5
2.	Rust remover (Wire brush)	Pcs	5	1:5
3.	Lubricants (Oil)	Lit	25	1:1
4.	Rugs	Kg	25	1:1
5.	Paper	A4	1 Pack	1:25
D. Tools and Equipment				
1.	Open wrench	10-24	Pcs	
2.	Boring tools - hand drill, Bench drill	Pcs	Pcs	
3.	Holding tools - vice grip, C-clamp and bench vice	Standard	5 From Each	1:5
4.	Threading tools - die and tap stock	Standard		
5.	Measuring instruments-	Standard		
6.	Hand tools-Allen key hammer players	Standard		

LEARNING MODULE 08	
TVET-PROGRAMME TITLE: Machining Level II	
MODULE TITLE: Performing precision shaping/planning/slotting operations	
MODULE CODE: IND MAC2 M 08 0322	
NOMINAL DURATION: .60 Hours	
MODULE DESCRIPTION: This module covers the knowledge, skills and attitudes required to performing precision shaping/planning/slotting operations.	
<p>LEARNING OUTCOMES</p> <p>At the end of the module the trainee will be able to:</p> <ul style="list-style-type: none"> LO1. Observe safety precautions LO2. Determine job requirements LO3. Perform precision shaping operations LO4. Perform precision planning operations LO5. Perform precision slotting operations LO6. Check component for conformance to specification 	
<p>MODULE CONTENTS:</p> <p>LO1. Observe safety precautions</p> <ul style="list-style-type: none"> 1.1 Observing correct safety procedures <ul style="list-style-type: none"> 1.1 Standard operating procedures, 1.2 safe working procedures 1.3 operation sheets <p>LO2. Determine job requirements.</p> <ul style="list-style-type: none"> 1.1 Interpreting drawings , sequence of operations and Selecting tools <ul style="list-style-type: none"> 1.1.1 Cutting tools 1.1.2 Tool holders 2.2. Determining cutting parameters <ul style="list-style-type: none"> 2.2.1. Feeds 2.2.2. Speeds 	

2.2.3. Depth of cut

2.2.4. Length Of Cut

LO3. Perform precision shaping operations

3.1. Careening out precision shaping operations flat surfaces, shoulders, slots, keyways, angles and dovetails.

LO4. Perform precision planning operations

4.1. Carrying out precision planning operations horizontal and vertical surfaces and angles

LO5. Perform precision slotting operations

5.1 Carrying out Precision slotting operations feathered and tapered keyways, slotting internal cavities, dovetails, slotting circular surfaces and internal splines

LO6. Check component for conformance to specification

6.1 Checking component for conformance using appropriate techniques, tools and equipment.

Learning Methods:				
For none impaired trainees	Reasonable Adjustment for Trainees with Disability (TWD)			
	Low Vision	Deaf	Hard of hearing	Physical impairment
Lecture discussion	<ul style="list-style-type: none"> ✚ Provide large print text ✚ Prepare the lecture in Audio/video ✚ Organize the class room seating arrangement to be accessible to trainees ✚ Write short notes on the black/white board using large text ✚ Make sure the luminosity of the light of class room is kept ✚ Use normal tone of voice ✚ Encourage trainees to record the lecture in audio format ✚ Provide Orientation on the physical feature of the work shop ✚ Summarize main points 	<ul style="list-style-type: none"> ✚ Assign sign language interpreter ✚ Arrange the class room seating to be conducive for eye to eye contact ✚ Make sure the luminosity of the light of class room is kept ✚ Introduce new and relevant vocabularies ✚ Use short and clear sentences ✚ Give emphasis on visual lecture and ensure the attention of the trainees ✚ Avoid movement during lecture time ✚ Present the lecture in video format 	<ul style="list-style-type: none"> ✚ Organize the class room seating arrangement to be accessible to trainees ✚ Speak loudly ✚ Ensure the attention of the trainees ✚ Present the lecture in video format ✚ Ensure the attention of the trainees 	<ul style="list-style-type: none"> ✚ Organize the class room seating arrangement to be accessible for wheelchairs users. ✚ Facilitate and support the trainees who have severe impairments on their upper limbs to take note ✚ Provide Orientation on the physical feature of the work shop

		❖ Summarize main points		
Demonstration	<ul style="list-style-type: none"> ✚ Conduct close follow up ✚ Use verbal description ✚ Provide special attention in the process of guidance ✚ facilitate the support of peer trainees ✚ Prepare & use simulation 	<ul style="list-style-type: none"> ✚ use Sign language interpreter ✚ Use video recorded material ✚ Ensure attention of the trainees ✚ Provide structured training ✚ Show clear and short method ✚ Use gesture ❖ provide tutorial support (if necessary) 	<ul style="list-style-type: none"> ✚ Illustrate in clear & short method ✚ Use Video recorded material ✚ Ensure the attention of the trainees ❖ provide tutorial support (if necessary) 	<ul style="list-style-type: none"> ✚ Facilitate and support the trainees having severe upper limbs impairment to operate equipment / machines ✚ Assign peer trainees to assist ✚ Conduct close follow up ❖ provide tutorial support (if necessary)
Group discussion	<ul style="list-style-type: none"> ✚ Facilitate the integration of trainees with group members ✚ Conduct close follow up ✚ Introduce the trainees with other group member ✚ Brief the thematic issues of the work 	<ul style="list-style-type: none"> ✚ Use sign language interpreters ✚ Facilitate the integration of trainees with group members ✚ Conduct close follow up ✚ Introduce the trainees with other group member 	<ul style="list-style-type: none"> ✚ Facilitate the integration of trainees with group members ✚ Conduct close follow up ✚ Introduce the trainees with other group member 	<ul style="list-style-type: none"> ❖ Introduce the trainees with their peers

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			❖ Inform the group members to speak loudly	
Exercise	<ul style="list-style-type: none"> ✚ Conduct close follow up and guidance ✚ Provide tutorial support if necessary ✚ provide special attention in the process 	<ul style="list-style-type: none"> ✚ Conduct close follow up and guidance ✚ Provide tutorial support if necessary ✚ provide special attention in the process/practical training ✚ Introduce new and relevant vocabularies 	<ul style="list-style-type: none"> ✚ Conduct close follow up and guidance ✚ Provide tutorial support if necessary ✚ provide special attention in the process/ practical training 	<ul style="list-style-type: none"> ✚ Assign peer trainees ✚ Use additional nominal hours if necessary
Individual assignment	<ul style="list-style-type: none"> ✚ prepare the assignment questions in large text ✚ Encourage the trainees to prepare and submit the assignment in large texts ✚ Make available recorded assignment questions ✚ Facilitate the trainees to prepare and submit the assignment in soft or 	<ul style="list-style-type: none"> ✚ Use sign language interpreter ✚ Provide briefing /orientation on the assignment ✚ Provide visual recorded material 	<ul style="list-style-type: none"> ✚ Provide briefing /orientation on the assignment ✚ Provide visual recorded material 	

	hard copy			
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ASSESSMENT METHODS:				
Interview		<ul style="list-style-type: none"> † Use sign language interpreter † Ensure or conform whether the proper communication was conducted with the trainee through the service of the sign language interpreter † Use short and clear questioning † Time extension 	<ul style="list-style-type: none"> † Speak loudly † Using sign language interpreter if necessary 	<ul style="list-style-type: none"> ❖ Use written response as an option for the trainees having speech challenges
Written test	<ul style="list-style-type: none"> † Prepare the exam in large texts † Use interview as an option if necessary † Prepare the exam in audio format † Assign human reader (if necessary) † Time extension 	<ul style="list-style-type: none"> † Prepare the exam using short sentences, multiple choices, True or False, matching and short answers † Avoid essay writing † Time extension 	<ul style="list-style-type: none"> ❖ Prepare the exam using short sentences, multiple choices, true or false, matching and short answers if necessary. 	<ul style="list-style-type: none"> † Use oral response as an option to give answer for trainees having severe upper limb impairment † Time extension for trainees having severe upper limb impairment

Demonstration /Observation	❖ Brief the instruction or provide them in large text	⚡ Use sign language interpreter ⚡ Brief on the instruction of the	⚡ Provide activity based assessment ⚡ Brief on the instruction of the exam	❖ Provide activity based assessment
	❖ Time extension	⚡ Provide activity-based/ practical assessment method ⚡ Time extension	⚡ Use loud voice ⚡ Time extension	⚡ Conduct close follow up ⚡ Time extension

ASSESSMENT CRITERIA:

LO.1. Observe safety precautions

- 1.1 Correct safety procedures are observed and protective clothing and safety glasses worn

LO.2 Determine job requirements

- 2.1 Drawings are interpreted, sequence of operations determined and tools selected to produce component to specification.
- 2.2 Cutting parameters are determined

LO.3. Perform precision shaping operations

- 3.1 Precision shaping operations are carried out including precision flat surfaces, shoulders, slots, keyways, angles and dovetails.

LO.4 Perform precision planning operations

- 4.1 Precision planning operations are carried out including horizontal and vertical surfaces and angles

LO5. Perform precision slotting operations

- 5.1 Precision slotting operations are carried out including feathered and tapered keyways, slotting internal cavities, dovetails, slotting circular surfaces and internal splines.

LO6. . Check component for conformance to specification

- 6.1 Component is checked for conformance to specification using appropriate techniques, tools and equipment.

IND MAC2 M08 0322 Performing precision shaping/planning/slotting operations				
Item No.	Category/Item	Description/ Specifications	Quantity	Recommended Ratio (Item: Trainee)
A. Learning Materials				
1.	TTLM	TTTLM prepared by the trainer	25	1:1
2.	Reference Books	Moltrecht, Karl Hans: Machine Shop Practice, 2nd ed. New York: Industrial Press, 1981, Volume 1, p. 403.	1	1:5
B. Learning Facilities & Infrastructure				
1.	Drawing Room	Standard	1	1:25
2.	Clinic	Standard	1	1:25
C. Consumable Materials				
1.	Copy paper drawing paper	A ₄ , ,	5packs	1:5
2.	Aluminum bar	500mmx ø 100mm	25pcs	1:1
3.	Aluminum bar	500mmx ø 50mm	25pcs	1:1
4.	Aluminum bar	500mmx ø 40mm	25pcs	1:1
5.	White Board Marker	Standard	1 pack	
6.	Mild steel round bar	6000mmx ø 100mm	25 pcs	1:1
7.	Mild steel round bar	6000mmx ø 70mm	1 pcs	1;25
8.	Mild steel round bar	6000mmx ø 50mm	1 pcs	1:25
9.	Mild steel round bar	6000mmx ø 30mm	5 pcs	1:5
10.	Mild steel round bar	6000mmx ø 20mm	5 pcs	1:5
11.	Mild steel round bar	6000mmx ø 12mm	5pcs	1:5
12.	different Power Hacksaw blade	Sweden	25 pcs	1:1
13.	Drill bit(different size)	Set ø1-13	2 pcs	1:12
D Tools and Equipment				
1.	End mill Cutter	Standard	5	1:5

2.	HSS (different size)	Standard	5	1:5
3.	White Board	Standard	1	1:25
4.	Files (different types)	Standard	5 pcs	1:5
5.	Divider	45 ⁰ X 90 ⁰	5 pcs	1:5
6.	Tape rule	30 ⁰ X 60 ⁰	25	1:1
7	Measuring Gages (different types)	Standard	5 pcs	1:5
8	Steel rule	Standard	5 pcs	1:5
9	Try square	Standard	25 pcs	1:1
10	LCD	Standard	1	1:25
11	Scriber	Standard	25 pcs	1:1
12	Bevel protractor	Standard	5 pcs	1:5
13	C- clamp	Standard	5 pcs	1:5
14	Bench vise	Standard	25 pcs	1:1
15	Height gauge	Standard	2 pcs	2:12
16	Surface plate	Standard	2 pcs	2:25
17	Angle plate	Standard	2 pcs	2:12
18	Vernier caliper	Standard	5 pcs	1:5
19	Vernier height gauge	Standard	2 pcs	2:12
20	Micrometers	Standard	5 pcs	1:5
21	Drill Press	Standard	2 pcs	2:12
22	Pedestal Grinder	Standard	2 pcs	2:12
23	Machine vise	Standard	5 pcs	1:5
24	Angle plate	Standard	4 pcs	1:6
25	Universal machine vice	Standard	3 pcs	1:8
26	Portable electric hand grinder	Standard	2 pcs	2:12
27	Work bench	Standard	7 pcs	1:3
28	Dressing tool	Standard	2 pcs	2:12
29	Dividing head / Indexing head with assessors	Standard	2 pcs	2:12

Acknowledgement

The **Ministry of Labor and Skills and Federal TVET Institute (FTI)** wishes to thank and appreciation for the trainers who donated their effort and time to develop this outcome based curriculum for the TVET program machining Level II. We also thank all regional TVET College, management institute at bishoftu programmers for active facilitation of their trainers for the development of this curriculum.

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