MECHANICS
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 manufacturing technology Level II**.**

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

TVET-Program Design

1.1. TVET-Program Title: Mechanics 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 mechanics 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 mechanics**.**

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 drawings for fabricated sheet metal products , Perform CAD Operation, Maintain and Repair Tools, Equipment and mechanical machine drive, Perform Fillet Shielded Metal Arc Welding (SMAW), Carry out Heat Treatment, Perform Hammer Forging, Perform basic foundry, Perform Equipment/Machine Layout, Setting and Leveling, Install and Maintain Fluid Power Pipes and Tubes and Prevent and Eliminate MUDA 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 MCS2 01 1221 Prepare drawings for fabricated sheet metal products

IND MCS2 02 1221 Perform CAD Operation

IND MCS2 03 1221 Maintain and Repair Tools, Equipment and mechanical machine drive.

IND MCS2 04 1221 Perform Fillet Shielded Metal Arc Welding (SMAW)

IND MCS2 05 1221 Carry out Heat Treatment

IND MCS2 06 1221 Perform Hammer Forging

IND MCS2 07 1221 Perform basic foundry

IND MCS2 08 1221 Perform Equipment/Machine Layout, Setting and Leveling

IND MCS2 09 1221 Install and Maintain Fluid Power Pipes and Tubes

IND MCS2 10 1221 Prevent and Eliminate MUDA

1.4. Duration of the TVET-Program

The Program will have duration of **610 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.

s.no	Unit competency	**TVET Institution training**		**Cooperative training**	**Total hours**	**Remarks**
		Theory	Practical			
1	Prevent and Eliminate MUDA	20	5	5	30	
2	Prepare drawings for fabricated sheet metal products	20	20	30	70	
3	Perform CAD Operation	20	60	--	80	
4	Maintain and Repair Tools, Equipment and mechanical machine drive.	20	40	20	80	
5	Perform Fillet Shielded Metal Arc Welding (SMAW)	20	40	20	80	
6	Carry out Heat Treatment	25	10	15	50	
7	Perform Hammer Forging	20	10	30	60	
8	Perform basic foundry	15	15	20	50	
9	Perform Equipment/Machine Layout, Setting and Leveling	20	10	20	50	
10	Install and Maintain Fluid Power Pipes and Tubes	25	15	20	60	
	Total hrs	205	225	145	**610 Hrs**	

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 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
IND MCS2 10 1221	Prevent and Eliminate MUDA	**IND MCS2 01 0322**	Preventing and Eliminating MUDA	• Prepare for wor • Identify MUDA • Analyze causes • Eliminate MUD effectiveness of • Prevent occurre sustain operatio
IND MCS2 01 1221	Prepare drawings for fabricated sheet metal products	**IND MCS2 M02 0322**	Preparing drawings for fabricated sheet metal products	• Access and inte • Identify fabrica • Prepare detail d • Document and s
IND MCS2 02 1221	Perform CAD Operation	**IND MCS2 M03 0322**	Performing CAD Operation	• Confirm drawin • Identify key fea • Access software work • Produce basic d • Complete CAD
IND MCS2 03 1221	Maintain and Repair Tools, Equipment and mechanical machine drive.	**IND MCS2 M04 0322**	Maintaining and Repairing Tools, Equipment and mechanical machine drive.	• Undertake prog maintenance ch • Undertake basic maintenance • Perform basic p of tools • Inventory tools
IND MCS2 04 1221	Perform Fillet Shielded Metal Arc Welding (SMAW)	**IND MCS2 M05 0322**	Performing Fillet Shielded Metal Arc Welding (SMAW)	• Prepare materia Equipment • Set-up welding accessories and • Set-up pre heati • Perform tack w • Perform SMAW • Perform Remov welding • Quality assure w
IND MCS2 05 1221	Carry out Heat Treatment	**IND MCS2M 06 0322**	Carrying out Heat Treatment	• Prepare for wor • Operate heating • Assure quality a
IND MCS2 06 1221	Perform Hammer Forging	**IND MCS2 M07 0322**	Performing Hammer Forging	• Analyze and pla • Prepare and sele • Perform hamme • Assure quality w

IND MCS2 07 1221	Perform basic foundry	**IND MCS2 M08 0322**	Performing basic foundry	• Identify job req Sequence of op • Select and prep and equipment • Make mold • Clean and resto
IND MCS2 08 1221	Perform Equipment/Mach ine Layout, Setting and Leveling	**IND MCS2 M09 0322**	Performing Equipment/Machine Layout, Setting and Leveling	• Plan and prepar • Perform layout • Perform setting alignment • Assure quality
IND MCS2 09 1221	Install and Maintain Fluid Power Pipes and Tubes	**IND MCS2 M10 0322**	Installing and Maintaining Fluid Power Pipes and Tubes	• Identify and pla • prepare and set- • Install fluid pov • Assure quality a

*The time duration (Hours) indicated for the module should include all activities in and out of the TVET institution.

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: **MECHANICS Level II**
MODULE TITLE: **Preventing and Eliminating MUDA**
MODULE CODE: **IND MCS2 M01 0322**
NOMINAL DURATION: **30 Hours**
MODULE DESCRIPTION: This module covers the knowledge, skills and attitude required to prevent and eliminate MUDA/wastes in his/her workplace by applying scientific problem-solving techniques and tools to enhance quality, productivity and other kaizen elements on continual basis. It covers responsibility for the day-to-day operation of the work and ensures Kaizen Elements are continuously improved and institutionalized.
LEARNING OUTCOMES At the end of the module the trainee will be able to: **LO1.** Prepare for work. **LO2.** Identify MUDA and problem **LO3.** Analyze causes of a problem **LO4:** Eliminate MUDA and Assess effectiveness of the solution **LO5:** Prevent occurrence of wastes and sustain operation.
MODULE CONTENTS: **LO1. Prepare for work.** 1.1 Using Work instructions to determine job requirements, 1.2 Reading and interpreting working manual. 1.3 Observing OHS requirements, 1.4 Selecting Appropriate material 1.5 Identifying and checking Safety equipment and tools LO2. **Identify MUDA and problem** 2.1 Following Visual Management Board/Kaizen Board. 2.2 Preparing and implementing Tools and techniques 2.3 Discussing Causes and effects of MUDA 2.4 Listing using statistical tools and techniques /Kaizen elements 2.5 Identifying and listing All possible problems related to kaizen elements 2.6 Identifying and measuring Wastes/MUDA based on relevant procedures. 2.7 Reporting wastes.

LO3. **Analyze causes of a problem**

3.1 Listing All possible causes of a problem

3.2 Analyzing Cause relationships using 4M1E.

3.3 Identifying Causes of the problems.

3.4 Selecting The root cause

3.5 Listing All possible ways using creative idea generation

3.6 Testing and evaluating the suggested solutions carefully.

3.7 Preparing Detailed summaries of the action plan

LO4: Eliminate MUDA and Assess effectiveness of the solution

4.1 Preparing and implementing Plan of MUDA elimination by medium KPT members

4.2 Using Tools and techniques to eliminate wastes/MUDA.

4.3 Reducing and eliminating Wastes/MUDA

4.4 Identifying Tangible and intangible results

4.5 Comparing Tangible results using various types of diagrams.

4.6 Reporting Improvements gained by elimination of waste/MUDA.

LO5: **Prevent occurrence of wastes and sustain operation.**

5.1 Preparing and implementing Plan of MUDA prevention

5.2 Discussing and preparing Standards required for machines

5.3 Preventing Occurrences of wastes/MUDA using visual and auditory control methods.

5.4 Creating Waste-free workplace using 5W and 1H sheet.

5.5 Doing the completion of required operation

5.6 Facilitating The updating of standard procedures and practices.

5.7 Ensuring and training the capability of the work team on the new Standard Operating Procedures (SOPs).

Learning Methods:				
For none impaired trainees	**Reasonable Adjustment for Trainees with Disability (TWD)**			
	Low Vision	**Deaf**	**Hard of hearing**	**Physical impairment**
Lecture-discussion	❖ 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	❖ 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 ❖ Summarize main points	❖ 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	❖ 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
Demonstration	❖ Conduct close follow up ❖ Use verbal description ❖ Provide special attention in the process of guidance ❖ facilitate the support of peer trainees ❖ Prepare & use simulation	❖ use Sign language interpreter ❖ Use video recorded material ❖ Ensure attention of the trainees ❖ Provide structured training ❖ Show clear and short method ❖ Use gesture ❖ rovide tutorial support (if necessary)	❖ Illustrate in clear & short method ❖ Use Video recorded material ❖ Ensure the attention of the trainees ❖ rovide tutorial support (if necessary)	❖ Facilitate and support the trainees having severe upper limbs impairment to operate equipments/ machines ❖ Assign peer trainees to assist ❖ Conduct close follow up ❖ rovide tutorial support (if necessary

Group discussion	❖ 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	❖ Use sign language interpreters ❖ Facilitate the integration of trainees with group members ❖ Conduct close follow up ❖ Introduce the trainees with other group member	❖ Facilitate the integration of trainees with group members ❖ Conduct close follow up ❖ Introduce the trainees with other group member ❖ Inform the group members to speak loudly	❖ Introduce the trainees with their peers
Exercise	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process/practical training ❖ Introduce new and relevant vocabularies	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process/ practical training	❖ Assign peer trainees ❖ Use additional nominal hours if necessary
Individual assignment	❖ 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	❖ Use sign language interpreter ❖ Provide briefing /orientation on the assignment ❖ Provide visual recorded material	❖ Provide briefing /orientation on the assignment ❖ Provide visual recorded material	

ASSESSMENT METHODS:				
Interview		❖ 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	❖ Speak loudly ❖ Using sign language interpreter if necessary	❖ Use written response as an option for the trainees having speech challenges
Written test	❖ 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	❖ Prepare the exam using short sentences, multiple choices, True or False, matching and short answers ❖ Avoid essay writing ❖ Time extension	❖ Prepare the exam using short sentences, multiple choices, true or false, matching and short answers if necessary.	❖ 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 ❖ Time extension	❖ Use sign language interpreter ❖ Brief on the instruction of the exam ❖ Provide activity-based/ practical assessment method ❖ Time extension	❖ Provide activity based assessment ❖ Brief on the instruction of the exam ❖ Use loud voice ❖ Time extension	❖ Provide activity based assessment ❖ Conduct close follow up ❖ Time extension

ASSESSMENT CRITERIA:

LO.1 Prepare for work.

- Work instructions are used to determine job requirements, including method, material and equipment.
- Job specifications are read and interpreted following working manual.
- OHS requirements, including dust and fume collection, breathing apparatus and eye and ear personal protection needs are observed throughout the work.
- Appropriate material is selected for work.
- Safety equipment and tools are identified and checked for safe and effective operation.

LO.2 Identify MUDA and problem

- Visual Management Board/Kaizen Board.
- Tools and techniques are used to draw and analyze current situation of the Plan of MUDA and problem identification is prepared and implemented.
- Causes and effects of MUDA are discussed.
- All possible problems related to the process /Kaizen elements are listed using statistical tools and techniques.
- All possible problems related to kaizen elements are identified and listed on work place.
- Wastes/MUDA are identified and measured based on relevant procedures.
- Identified and measured wastes are reported to relevant personnel.

LO.3 Analyze causes of a problem

- All possible causes of a problem are listed.
- Cause relationships are analyzed using4M1E.
- Causes of the problems are identified.
- The root cause which is most directly related to the problem is selected.
- All possible ways are listed using creative idea generation to eliminate the most critical root cause.
- The suggested solutions are carefully tested and evaluated for potential complications.
- Detailed summaries of the action plan are prepared to implement the suggested solution.

LO4: Eliminate MUDA and Assess effectiveness of the solution

- Plan of MUDA elimination is prepared and implemented by medium KPT members.
- Necessary attitude and the ten basic principles for improvement are adopted to eliminate waste/MUDA.
- Tools and techniques are used to eliminate wastes/MUDA based on the procedures and OHS.
- Wastes/MUDA are reduced and eliminated in accordance with OHS and organizational requirements.

- Tangible and intangible results are identified.
- Tangible results are compared with targets using various types of diagrams
- Improvements gained by elimination of waste/MUDA are reported to relevant bodies.

LO5: Prevent occurrence of wastes and sustain operation.

- Plan of MUDA prevention is prepared and implemented.
- Standards required for machines, operations, defining normal and abnormal conditions, clerical procedures and procurement are discussed and prepared.
- Occurrences of wastes/MUDA are prevented by using visual and auditory control methods.
- Waste-free workplace is created using 5W and 1Hsheet.
- The completion of required operation is done in accordance with standard procedures and practices.
- The updating of standard procedures and practices is facilitated.
- The capability of the work team that aligns with the requirements of the procedure is ensured and trained on the new Standard Operating Procedures (SOPs).

Annex: Resource Requirements

IND MCS2 M01 0322 Preventing and Eliminating MUDA				
Item No.	Category/Item	Description/ Specifications	Quantity	Recommended Ratio (Item: Learner)
A.	**Learning Materials**			
1.	TTLM	Prepared by trainers	5	1:5
2.	Textbooks			
3.	Reference Books	-Grzelczak A, Lewandowska KW (2016) Eliminating Muda (Waste) in Lean Management by Working Time Standardization	5	1:5
4.	Journals/Publication/Magazines			
B.	**Learning Facilities & Infrastructure**			
1.	Lecture Room	5x7m	1	1:25
2.	Library	10x20m	1	1:25
C.	**Consumable Materials**			
1.	Dust masks/goggles		25	1:1
2.	Glove	Pairs	25	1:1
3	Working cloth		25	1:1
4	First aid		1	1:25
5	Safety shoes	Pairs	25	1:1
D.	**Tools and Equipments**			
1.	Visual training media (LCD,,)		1	1:25
2	Blackboard		1	1:25
3	whiteboard,		1	1:25

LEARNING MODULE 02

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

MODULE TITLE: **Preparing drawings for fabricated sheet metal products**

MODULE CODE: **IND MCS2 M02 0322**

NOMINAL DURATION**: 70 Hours**

MODULE DESCRIPTION: This unit of competency covers the skills, knowledge and attitudes required to prepare detail drawings for fabrication of sheet metal products

LEARNING OUTCOMES

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

LO1. Access and interpret specifications

LO2. Identify fabrication techniques

LO3. Prepare detail drawing

LO4. Document and store drawings

MODULE CONTENTS:

LO1. Access and interpret specifications

1.1 Identifying sheet metal products fabricated techniques

1.2 Interpreting specifications and requirements for sheet metal product

1.3 interpreting organizational and industry standards

LO2. Identify fabrication techniques

2.1 Identifying features of sheet metal products

2.2 Identifying materials used in fabricated products

2.3 Identify terminology, symbols and standards

LO3. **Prepare detail drawing**

3.1 Performing calculations

3.3 Marking out the drawing accordance with industry specification

3.4 Ensuring detail drawing including relevant information, full notation and dimensioning.

LO4. **Document and store drawings**

4.1 Documenting drawings.

4.2 Storing drawings.

Learning Methods:				
For none impaired trainees	**Reasonable Adjustment for Trainees with Disability (TWD)**			
	Low Vision	**Deaf**	**Hard of hearing**	**Physical impairment**
Lecture-discussion	❖ 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	❖ 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 ❖ Summarize main points	❖ 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	❖ 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
Demonstration	❖ Conduct close follow up ❖ Use verbal description ❖ Provide special attention in the process of guidance ❖ facilitate the support of peer trainees ❖ Prepare & use simulation	❖ use Sign language interpreter ❖ Use video recorded material ❖ Ensure attention of the trainees ❖ Provide structured training ❖ Show clear and short method ❖ Use gesture ❖ rovide tutorial support (if necessary)	❖ Illustrate in clear & short method ❖ Use Video recorded material ❖ Ensure the attention of the trainees ❖ rovide tutorial support (if necessary)	❖ Facilitate and support the trainees having severe upper limbs impairment to operate equipments/ machines ❖ Assign peer trainees to assist ❖ Conduct close follow up ❖ rovide tutorial support (if necessary
Group discussion	❖ Facilitate the integration of trainees with group members ❖ Conduct close follow up ❖ Introduce the trainees with other group member	❖ Use sign language interpreters ❖ Facilitate the integration of trainees with group members ❖ Conduct close follow up ❖ Introduce the trainees with other	❖ Facilitate the integration of trainees with group members ❖ Conduct close follow up	❖ Introduce the trainees with their peers

	❖ Brief the thematic issues of the work	group member	❖ Introduce the trainees with other group member ❖ Inform the group members to speak loudly	
Exercise	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process/practical training ❖ Introduce new and relevant vocabularies	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process/ practical training	❖ Assign peer trainees ❖ Use additional nominal hours if necessary
Individual assignment	❖ 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	❖ Use sign language interpreter ❖ Provide briefing /orientation on the assignment ❖ Provide visual recorded material	❖ Provide briefing /orientation on the assignment ❖ Provide visual recorded material	
ASSESSMENT METHODS:				
Interview		❖ 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	❖ Speak loudly ❖ Using sign language interpreter if necessary	❖ Use written response as an option for the trainees having speech challenges

Written test	❖ 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	❖ Prepare the exam using short sentences, multiple choices, True or False, matching and short answers ❖ Avoid essay writing ❖ Time extension	❖ Prepare the exam using short sentences, multiple choices, true or false, matching and short answers if necessary.	❖ 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 ❖ Time extension	❖ Use sign language interpreter ❖ Brief on the instruction of the exam ❖ Provide activity-based/ practical assessment method ❖ Time extension	❖ Provide activity based assessment ❖ Brief on the instruction of the exam ❖ Use loud voice ❖ Time extension	❖ Provide activity based assessment ❖ Conduct close follow up ❖ Time extension

ASSESSMENT CRITERIA:

LO.1 Access and interpret specifications

- Identify design process for fabricated techniques sheet metal products
- Interpret specifications and requirements for product and determine implications and requirements for fabrication
- Access and interpret organizational and industry standards, information and catalogues to obtain required product specifications

LO.2 Identify fabrication techniques

- Identify features of sheet metal products and techniques used in fabrication
- Identify characteristics of metal materials used in fabricated products and implications for fabrication techniques
- Identify terminology, symbols and standards used in drawings for fabricated products and required inclusions for fabrication drawings

LO.3 Prepare detail drawing

- Perform calculations required to complete drawings to specifications
- Lay out the drawing in accordance with specifications and industry conventions
- Ensure detail drawing accurately reflects specifications, is presented according to organizational requirements and contains all relevant information, including full notation and dimensioning

LO.4 Document and store drawings

- Document drawings and associated technical information in accordance with project requirements and organizational procedures
- Store drawings according to organizational procedures

Annex: Resource Requirements

IND MCS2 M02 0322 Preparing drawings for fabricated sheet metal products				
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	1. Beddoes J., Principles of Metal Manufacturing processes, John Wiles & Sons Inc . New York , 1999 2. HajraChoudhory C.J., "Elements of workshop Technology ", Vol. I to Vol. III, Asia Publishing House, 1992.	5	1:5
3	Journals/Publication/Magazines			
B.	**Learning Facilities & Infrastructure**			
1.	Lecture Room	6m*8m	1	1:25
2.	Library	10m*15m	1	1:25
3.	Workshop	20m*20m	1	1:25
C.	**Consumable Materials**			
1.	Drawing paper	(A4,A3..)	5 Pack	1:5
3	Classer	Hard paper	5 pack	1:5
4	Drafting tape	Roll	5	1:5
5	Mild steel Sheet metal	1000x2000x0.8mm	10	1:5
6	Galvanized sheet metal	1000x2000x0.6mm	10	1:5
D.	**Tools and Equipments**			
1	Steel rule	50cm	25	1:1
2	Ball peen Hammer	2kgs.	25	1:1
3	Mallet	Plastic	25	1:1
4	Divider	STD	25	1:1
5	Try square	STD	25	1:1
6	Snips	STD	25	1:1
7	Stakes	STD	5	1:5
8	Bench shear	STD	5	1:5
9	Folding machine	STD	5	1:5
10	Drilling machine	STD	5	1:5
11	Arc Welding machine	AC/DC	5	1:5
12	Bench shear	STD	5	1:5

13	Rivet gun & rivet	STD	5	1:5

LEARNING MODULE 03
TVET-PROGRAMME TITLE: **MECHANICS Level II**
MODULE TITLE: **Performing CAD Operation**
MODULE CODE: **IND MCS2 M03 0322**
NOMINAL DURATION**: 80 Hours**
MODULE DESCRIPTION: This unit covers the skills, knowledge 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**. Access software and set up for drawing work **LO4.** Produce basic drawing elements **LO5.** Complete CAD operations

MODULE CONTENTS:

LO1. Confirm drawing requirements

1.1. Confirming Purpose, scope, information and presentation of drawing requirement

1.2. Identifying work requirement

1.3. Identifying equipment and software

LO2. Identify key features of CAD software

2.1. Describing CAD software and their key futures

2.2. Identifying 2-D drawings, 3-D models in CAD processes

2.3. Identifying peripheral equipment and software programs compatibility

LO3. Access software and set up for drawing work

3.1. Opening CAD software

3.2. Identifying organizational and software templates

3.3. Identifying symbols, codes and standards

LO4. Produce basic drawing elements

4.1. Using basic drawing elements

4.2. Editing and transfer tools and methods

4.3. Applying Dimensions, text and symbols

4.4. Importing and exporting files

4.5. Generating different views and perspectives

LO5. Complete CAD operations

5.1. Saving drawing elements

5.2. Printing 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	❖ 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	❖ 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 ❖ Summarize main points	❖ 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	❖ 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
Demonstration	❖ Conduct close follow up ❖ Use verbal description ❖ Provide special attention in the process of guidance ❖ facilitate the support of peer trainees ❖ Prepare & use simulation	❖ use Sign language interpreter ❖ Use video recorded material ❖ Ensure attention of the trainees ❖ Provide structured training ❖ Show clear and short method ❖ Use gesture ❖ rovide tutorial support (if necessary)	❖ Illustrate in clear & short method ❖ Use Video recorded material ❖ Ensure the attention of the trainees ❖ rovide tutorial support (if necessary)	❖ Facilitate and support the trainees having severe upper limbs impairment to operate equipments/ machines ❖ Assign peer trainees to assist ❖ Conduct close follow up ❖ rovide tutorial support (if necessary
Group discussion	❖ Facilitate the integration of trainees with group members ❖ Conduct close follow up	❖ Use sign language interpreters ❖ Facilitate the integration of trainees with group members	❖ Facilitate the integration of trainees with group members	❖ Introduce the trainees with their peers

	❖ Introduce the trainees with other group member ❖ Brief the thematic issues of the work	❖ Conduct close follow up ❖ Introduce the trainees with other group member	❖ Conduct close follow up ❖ Introduce the trainees with other group member ❖ Inform the group members to speak loudly	
Exercise	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process/practical training ❖ Introduce new and relevant vocabularies	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process/ practical training	❖ Assign peer trainees ❖ Use additional nominal hours if necessary
Individual assignment	❖ 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	❖ Use sign language interpreter ❖ Provide briefing /orientation on the assignment ❖ Provide visual recorded material	❖ Provide briefing /orientation on the assignment ❖ Provide visual recorded material	

ASSESSMENT METHODS:

Interview		❖ 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	❖ Speak loudly ❖ Using sign language interpreter if necessary	❖ Use written response as an option for the trainees having speech challenges
Written test	❖ Prepare the exam in large texts ❖ Use interview as an option if necessary ❖ Prepare the exam in audio format ❖ Assign human reader	❖ Prepare the exam using short sentences, multiple choices, True or False, matching and short answers ❖ Avoid essay writing	❖ Prepare the exam using short sentences, multiple choices, true or false, matching and short answers if necessary.	❖ Use oral response as an option to give answer for trainees having severe upper limb impairment

	❖ (if necessary) ❖ Time extension	❖ Time extension		❖ Time extension for trainees having severe upper limb impairment
Demonstration/ Observation	❖ Brief the instruction or provide them in large text ❖ Time extension	❖ Use sign language interpreter ❖ Brief on the instruction of the exam ❖ Provide activity-based/ practical assessment method ❖ Time extension	❖ Provide activity based assessment ❖ Brief on the instruction of the exam ❖ Use loud voice ❖ Time extension	❖ Provide activity based assessment ❖ Conduct close follow up ❖ Time extension

ASSESSMENT CRITERIA:

LO.1 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.

LO.2 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 is identified.

LO.3 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

LO.3 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
- Import and export files into/out of working space
- Different views and perspectives are generated

LO.3 Complete CAD operations

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

Annex: Resource Requirements

IND MCS2 M03 0322 Performing CAD Operation				
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	-Cherly R. Shock, Auto CAD 2006, IP Publication,4th Edition -Dorothy Kent, The Auto CAD Reference Guide,3rd Edition	5	1:5
3.	Textbooks			
4.	Journals/Publication/Magazines			
B.	**Learning Facilities & Infrastructure**			
1.	Lecture Room	6m*8m	1	1:25
2.	Library	10m*15m	1	1:25
3.	Workshop	20m*20m	1	1:25
C.	**Consumable Materials**			
1.	Paper	A2	1rim	1:25
		A3	1rim	
		A4	1rim	
D.	**Tools and equipment's**			
1.	Computer	Desk top	25	1:1
2.	Drawing instrument	STD	As required	1:1
3	CAD Software			
4	USB flash disk			

LEARNING MODULE 04
TVET-PROGRAMME TITLE: MECHANICS **Level II**
MODULE TITLE: **Maintaining and Repairing Tools, Equipment and mechanical machine drive**
MODULE CODE: **IND MCS2 M04 0322**
NOMINAL DURATION. **80 Hours**
MODULE DESCRIPTION: This module covers the skill, knowledge and attitudes required in carrying out compulsory and routine safety and maintenance checks on machines and equipment, calibrate measuring instruments and tools in a manufacturing setting.
LEARNING OUTCOMES At the end of the module the trainee will be able to: **LO1. Undertake programmed safety and maintenance checks** **LO2. Undertake basic programmed maintenance** **LO3. Perform basic preventive maintenance of tools** **LO4. Inventory tools and equipment**
MODULE CONTENTS: **LO1. Undertake programmed safety and maintenance checks** 1.1 Checking tools and machines/equipment 1.2 Undertaking safely and to prescribing operational procedures. 1.3 Checking measuring instruments 1.4 Segregating and labeling non-functional tools, instruments and equipment 1.5 Recording on pro-forma or reporting orally **LO2. Undertake basic programmed maintenance** 2.1 Cleaning and lubricating machines/equipment 2.1. Undertaking removing/replacing consumable components. 2.2. Replacing fluids and lubricants 2.3. Performing minor machine repairs 2.4. Adjusting machine moving parts
LO3. Perform basic preventive maintenance of tools 3.1. Checking tools for defects 3.2. Reporting for repairing or replacing defective hand tools 3.3. Cleaning tools using appropriate cleaning materials 3.4. Lubricating and storing tools. 3.5. 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 safely in appropriate locations.

Learning Methods:				
For none impaired trainees	**Reasonable Adjustment for Trainees with Disability (TWD)**			
	Low Vision	**Deaf**	**Hard of hearing**	**Physical impairment**
Lecture-discussion	❖ 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	❖ 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 ❖ Summarize main points	❖ 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	❖ 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
Demonstration	❖ Conduct close follow up ❖ Use verbal description ❖ Provide special attention in the process of guidance ❖ facilitate the support of peer trainees ❖ Prepare & use simulation	❖ use Sign language interpreter ❖ Use video recorded material ❖ Ensure attention of the trainees ❖ Provide structured training ❖ Show clear and short method ❖ Use gesture ❖ rovide tutorial support (if necessary)	❖ Illustrate in clear & short method ❖ Use Video recorded material ❖ Ensure the attention of the trainees ❖ rovide tutorial support (if necessary)	❖ Facilitate and support the trainees having severe upper limbs impairment to operate equipments/ machines ❖ Assign peer trainees to assist ❖ Conduct close follow up ❖ rovide tutorial support (if necessary
Group discussion	❖ 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	❖ Use sign language interpreters ❖ Facilitate the integration of trainees with group members ❖ Conduct close follow up ❖ Introduce the trainees with other group member	❖ Facilitate the integration of trainees with group members ❖ Conduct close follow up ❖ Introduce the trainees with other group member ❖ Inform the group members to speak loudly	❖ Introduce the trainees with their peers

Exercise	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process/practical training ❖ Introduce new and relevant vocabularies	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process/ practical training	❖ Assign peer trainees ❖ Use additional nominal hours if necessary
Individual assignment	❖ 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	❖ Use sign language interpreter ❖ Provide briefing /orientation on the assignment ❖ Provide visual recorded material	❖ Provide briefing /orientation on the assignment ❖ Provide visual recorded material	
ASSESSMENT METHODS:				
Interview		❖ 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	❖ Speak loudly ❖ Using sign language interpreter if necessary	❖ Use written response as an option for the trainees having speech challenges
Written test	❖ 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	❖ Prepare the exam using short sentences, multiple choices, True or False, matching and short answers ❖ Avoid essay writing ❖ Time extension	❖ Prepare the exam using short sentences, multiple choices, true or false, matching and short answers if necessary.	❖ 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 ❖ Time extension	❖ Use sign language interpreter ❖ Brief on the instruction of the exam ❖ Provide activity-based/ practical assessment method ❖ Time extension	❖ Provide activity based assessment ❖ Brief on the instruction of the exam ❖ Use loud voice ❖ Time extension	❖ Provide activity based assessment ❖ Conduct close follow up ❖ Time extension

ASSESSMENT CRITERIA:

LO1. Undertake programmed 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.

LO.2 Undertake basic programmed 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 are performed according to manual instruction or workplace procedures
- Machine moving parts are adjusted to manufacturer's specifications.

LO.3 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 procedures

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

Annex: Resource Requirements

IND MCS2 M04 0322 Maintain and Repair Tools, Equipment and mechanical machine drive				
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	Industrial machinery repair: best maintenance practices pocket guide by; Ricky Smith 2003	5	1:5
3	Text books			
4.	Journals/Publication/Magazines			
B.	**Learning Facilities & Infrastructure**			
1.	Lecture Room	Standard		1:25
2.	Library	Standard		1:25
3.	Laboratory	Standard		1:25
C.	**Consumable Materials**			
1.	Air filters, oil wipers, grease containers, tool tips, indicator globes, fluids and lubricants, guides and limit switch actuators	STD	As required	1:1
D.	**Tools and Equipments**			
1.	Hand and power tools,	STD	5	1:5
2.	Measuring tools,	STD	As required	1:5
3.	Protective clothing and equipment	STD	25	1:1

LEARNING MODULE 05
TVET-PROGRAMME TITLE: MECHANICS **Level II**
MODULE TITLE: **Performing Fillet Shielded Metal Arc Welding (SMAW)**
MODULE CODE: **IND MCS2 M05 0322**
NOMINAL DURATION. **80 Hours**
MODULE DESCRIPTION: This module covers the skill, knowledge and attitudes required in carrying out Shielded Metal Arc Welding (SMAW) in fabrication and assembly of metal works.
LEARNING OUTCOMES At the end of the module the trainee will be able to: **LO1.** Prepare materials, Tools and Equipment **LO2**. Set-up welding machine / equipment, accessories and fixtures **LO3**. Set-up pre heating tools/ equipment **LO4**. Perform tack welding **LO5**. Perform SMAW welds **LO6**. Perform Remove defects and re-welding **LO7**. Quality assure weld conformance
MODULE CONTENTS: **LO1. Prepare materials, Tools and Equipment** 1.1. Identifying welding works from order 1.2. Determining the correct size, type and quantity of materials. 1.3. Preparing the materials correctly. 1.4. Assembling /aligning materials to specification. 1.5. Identifying welding machine and its accessories. 1.6. Preparing appropriate tools and equipment to the work requirements. 1.7. Ensuring safe working area for standardizing welding processes **LO2. Set-up welding machine / equipment, accessories and fixtures** 2.1. Identifying and selecting welding machine settings, accessories and consumables. 2.2. Connecting welding machines 2.3. Adjusting current and voltage 2.4. Providing and in conformity of Braces, stiffeners, rails and other jigs. 2.5. Selecting for weld and material type in appropriate distortion preventing measures.

LO3. Set-up pre heating tools/ equipment

3.1. Set-up pre-heating equipment

3.2. Operating equipment.

3.3. Checking the defects /functionality of tools and equipment's.

3.4 Cleaning, lubricating and storing tools and equipment.

LO4. Perform tack welding

4.1. Joining made free from rust prior to fit

4.2. Performing the root gap

4.3. Checking the alignment within code and standard.

4.4. Installing backing plate, stiffener and running plate as requiring.

4.5. Performing tack welding.

LO5. Perform SMAW Welds

5.1. Performing root pass

5.2. Cleaning the root pass in accordance with procedures.

5.3. Performing subsequent filling passes

5.4. Performing capping

5.5. Removed defects

5.6. Ensuring weld deposit within specifications.

5.7. Welding the materials using SMAW process.

5.8. Cleaning the joints freed from discontinuities.

LO 6. Perform Remove defects and re-welding

6.1. Locating and marking weld defects.

6.2. Removing welding defects

6.3. Minimizing and cleaning removal of non-defective welds.

6.4. Performing visual test

6.5. Informing welding inspector for the extent of defect removal to be verifying.

6.6. Performing re-welding tasks in accordance with company/ industry requirement

LO7. Quality assure weld conformance

7.1. Making welds free from defects.

7.2. Inspecting welding joints.

7.3. Welding records and completion details

7.4. Observing OHS procedures.

7.5. Reporting defective hand tools and equipment for repair

Learning Methods:				
For none impaired trainees	**Reasonable Adjustment for Trainees with Disability (TWD)**			
	Low Vision	**Deaf**	**Hard of hearing**	**Physical impairment**
Lecture-discussion	❖ 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	❖ 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 ❖ Summarize main points	❖ 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	❖ 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
Demonstration	❖ Conduct close follow up ❖ Use verbal description ❖ Provide special attention in the process of guidance ❖ facilitate the support of peer trainees ❖ Prepare & use simulation	❖ use Sign language interpreter ❖ Use video recorded material ❖ Ensure attention of the trainees ❖ Provide structured training ❖ Show clear and short method ❖ Use gesture ❖ rovide tutorial support (if necessary)	❖ Illustrate in clear & short method ❖ Use Video recorded material ❖ Ensure the attention of the trainees ❖ rovide tutorial support (if necessary)	❖ Facilitate and support the trainees having severe upper limbs impairment to operate equipments/ machines ❖ Assign peer trainees to assist ❖ Conduct close follow up ❖ rovide tutorial support (if necessary
Group discussion	❖ 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	❖ Use sign language interpreters ❖ Facilitate the integration of trainees with group members ❖ Conduct close follow up ❖ Introduce the trainees with other group member	❖ Facilitate the integration of trainees with group members ❖ Conduct close follow up ❖ Introduce the trainees with other group member ❖ Inform the group	❖ Introduce the trainees with their peers

			members to speak loudly	
Exercise	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process/practical training ❖ Introduce new and relevant vocabularies	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process/ practical training	❖ Assign peer trainees ❖ Use additional nominal hours if necessary
Individual assignment	❖ 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	❖ Use sign language interpreter ❖ Provide briefing /orientation on the assignment ❖ Provide visual recorded material	❖ Provide briefing /orientation on the assignment ❖ Provide visual recorded material	
ASSESSMENT METHODS:				
Interview		❖ 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	❖ Speak loudly ❖ Using sign language interpreter if necessary	❖ Use written response as an option for the trainees having speech challenges
Written test	❖ 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	❖ Prepare the exam using short sentences, multiple choices, True or False, matching and short answers ❖ Avoid essay writing ❖ Time extension	❖ Prepare the exam using short sentences, multiple choices, true or false, matching and short answers if necessary.	❖ 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 ❖ Time extension	❖ Use sign language interpreter ❖ Brief on the instruction of the exam ❖ Provide activity-based/ practical assessment method ❖ Time extension	❖ Provide activity based assessment ❖ Brief on the instruction of the exam ❖ Use loud voice ❖ Time extension	❖ Provide activity based assessment ❖ Conduct close follow up ❖ Time extension

ASSESSMENT CRITERIA:

LO1. Prepare materials, Tools and Equipment

- Weld work is identified from order and/or drawings in accordance with industry standards
- Correct size, type and quantity of materials/ components are determined, obtained and inspected for compliance with the job specifications
- Materials are correctly prepared in accordance with job specifications
- Materials are assembled/aligned to specification, where required
- Welding machine and its accessories are identified
- Tools and equipment are prepared appropriate to the work requirements
- Work area is ensured to be safe for standardized welding processes

LO 2.Set-up welding machine / equipment, accessories and fixtures

- Welding machine settings, accessories and consumables are identified and selected based on standards
- Welding machine is connected to an independent power supply and wired up or set to the polarity indicated in the welding procedures /specifications or as recommended by the manufacturer
- Current and voltage fine-tuned or adjusted consistent with work requirements to produce acceptable weld
- Braces, stiffeners, rails and other jigs are provided and in conformity with requirements.
- Appropriate distortion prevention measures are selected for weld and material type in according to requirements

LO 3.Set-up pre heating tools/ equipment

- Pre-heating equipment is set-up appropriate to the job requirement and specifications
- Equipment is operated in conformance with the manufacturer's instructions
- Tools and equipment are regularly checked for defects /functionality according to standards
- Tools and equipment are cleaned, lubricated and stored according to prescribed procedure

LO4. Perform tack welding

- Joints are made free from rust, paints, grease and other foreign materials prior to fit up or tacking based on Welding Procedure Specification (WPS)

- Root gap is performed in accordance with the requirements of WPS
- Alignment is checked within the range of acceptability of code and standard.
- Backing plate, stiffener and running plate are installed as required.
- Tack welding is performed in accordance with the requirements of WPS and client's specifications
- Tack weld is dimensionally acceptable and is made visually free from stresses

LO 5. Perform SMAW welds

- Root pass is performed in accordance with specifications and enterprise / industry standards and safety procedures.
- Root pass is cleaned in accordance with procedures.
- Subsequent filling passes are performed in accordance with procedures
- Capping is performed in accordance with specifications and procedures.
- Defects are removed with minimum loss of sound metal using correct and appropriate techniques and tools.
- Weld deposit is ensured to be within specifications.
- Materials are welded using SMAW process in accordance with specifications
- Joints are cleaned and freed from discontinuities.

LO 6.Perform Remove defects and re-welding

- Weld defects are located and marked following standard procedures and practice.
- Weld defects are removed in accordance with approved industry procedures or client requirements.
- Removal of non-defective welds is minimized and cleaned due to requirements.
- Visual test is performed to verify the extent of removal of defects, where applicable based on comparable standards
- The extent of defect removal is to be verified by informed welding inspector
- Re-Welding tasks are performed in accordance with company/ industry requirement and safety procedures.

LO 7.Quality assure weld conformance

- Welded parts are made free from weld defects or porosity according to WPS .
- Weld joints are visually inspected for conformance to specifications.
- Weld records and completion details are completed and maintained correctly as

required.

- OHS procedures are observed throughout this unit.
- Defective hand tools and equipment are reported for repair or replacement in compliance with regulations.

Annex: Resource Requirements

IND MCS2 05 0322 Performing Fillet Shielded Metal Arc Welding (SMAW)				
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	-Beddoes J., Principles of Metal Manufacturing processes, John Wiles & Sons Inc. New York , 1999	5	1:5
3	Text books			
4.	Journals/Publication/Magazines			
B.	**Learning Facilities & Infrastructure**			
1.	Lecture Room	Standard		1:25
2.	Library	Standard		1:25
3.	Laboratory	Standard		1:25
C.	**Consumable Materials**			
1.	Carbon or mild steel, Electrode, Filler wires etc	6000x50x5mm, dia.2.5-4mm	As required	1:1
D.	**Tools and Equipment's**			
1.	Welding machine with accessory	STD	5	1:5
2.	Hand and power tools,	STD	5	1:5
3.	Measuring tools,	STD	5	1:5
4	Protective clothing and equipment	Pcs.	25	1:1
5	Chipping Hammer	STD	5	1:5
6	Steel Brush	STD	5	1:5
7	Portable Grinder	Makita	5	1:5
8	Cutting disc.	180 mmØ	5	1;5

LEARNING MODULE 06
TVET-PROGRAMME TITLE: Mechanics **Level II**
MODULE TITLE: **Carrying out Heat Treatment**
MODULE CODE: **IND MCS2 M06 0322**
NOMINAL DURATION: **50 Hours**
MODULE DESCRIPTION: This unit covers the skills, knowledge and attitudes required in performing heat treatment of ferrous and non-ferrous metals, selecting the appropriate process to achieve the desired result using a variety of equipment.
LEARNING OUTCOMES At the end of the module the trainee will be able to: **LO1. Prepare for work** **LO2. Operate heating equipment** **LO3**. **Assure quality and clean up**
MODULE CONTENTS: **LO1. Prepare for work** 1.1 Using Personal protective equipment 1.2 Determining work requirements. 1.3 Selecting appropriate heat-treatment equipment and process **LO2. Operate heating equipment** 2.1 Identifying hazards and implement control measures 2.2 Mmaintaining safe work environment 2.3 Performing Furnace start-up 2.4 Applying and maintaining heating temperature. 2.4.1 Soaking time 2.4.2 Cooling time 2.5 Heat treating Materials **LO3**. **Assure quality and clean up** 3.1 Testing Heat treated material 3.2 Cleaning Work area and recycling materials 3.3 Identifying Dimensions and material requirements 3.4 Interpreting dimensional tolerances and notations

Learning Methods:				
For none impaired trainees	**Reasonable Adjustment for Trainees with Disability (TWD)**			
	Low Vision	**Deaf**	**Hard of hearing**	**Physical impairment**
Lecture-discussion	❖ 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	❖ 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 ❖ Summarize main points	❖ 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	❖ 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

Demonstration	❖ Conduct close follow up ❖ Use verbal description ❖ Provide special attention in the process of guidance ❖ facilitate the support of peer trainees ❖ Prepare & use simulation	❖ use Sign language interpreter ❖ Use video recorded material ❖ Ensure attention of the trainees ❖ Provide structured training ❖ Show clear and short method ❖ Use gesture ❖ rovide tutorial support (if necessary)	❖ Illustrate in clear & short method ❖ Use Video recorded material ❖ Ensure the attention of the trainees ❖ rovide tutorial support (if necessary)	❖ Facilitate and support the trainees having severe upper limbs impairment to operate equipments/ machines ❖ Assign peer trainees to assist ❖ Conduct close follow up ❖ rovide tutorial support (if necessary
Group discussion	❖ 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	❖ Use sign language interpreters ❖ Facilitate the integration of trainees with group members ❖ Conduct close follow up ❖ Introduce the trainees with other group member	❖ Facilitate the integration of trainees with group members ❖ Conduct close follow up ❖ Introduce the trainees with other group member ❖ Inform the group members to speak loudly	❖ Introduce the trainees with their peers

Exercise	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process/practical training ❖ Introduce new and relevant vocabularies	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process/ practical training	❖ Assign peer trainees ❖ Use additional nominal hours if necessary
Individual assignment	❖ 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	❖ Use sign language interpreter ❖ Provide briefing /orientation on the assignment ❖ Provide visual recorded material	❖ Provide briefing /orientation on the assignment ❖ Provide visual recorded material	

ASSESSMENT METHODS:				
Interview		❖ Use sign language interpreter ❖ Ensure or conform whether the proper communication	❖ Speak loudly ❖ Using sign language interpreter if necessary	❖ Use written response as an option for the

		was conducted with the trainee through the service of the sign language interpreter ❖ Use short and clear questioning ❖ Time extension		trainees having speech challenges
Written test	❖ 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	❖ Prepare the exam using short sentences, multiple choices, True or False, matching and short answers ❖ Avoid essay writing ❖ Time extension	❖ Prepare the exam using short sentences, multiple choices, true or false, matching and short answers if necessary.	❖ 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 ❖ Time extension	❖ Use sign language interpreter ❖ Brief on the instruction of the exam ❖ Provide activity-based/ practical assessment method ❖ Time extension	❖ Provide activity based assessment ❖ Brief on the instruction of the exam ❖ Use loud voice ❖ Time extension	❖ Provide activity based assessment ❖ Conduct close follow up ❖ Time extension

ASSESSMENT CRITERIA:

LO.1 Prepare for work

- Personal protective equipment/devices are used in accordance with Occupational Health and Safety (OHS) requirements
- Work requirements are determined from engineering drawing, job sheet or verbal instructions
- Heating equipment are selected for the required heat treatment process.
- Equipment is selected according to standard operating procedures and/or manufacturer's instructions

LO.2 Operate heating equipment

- Hazards are identified and control measures implemented to maintain a safe work environment.
- Furnace start-up is performed as per standard operating procedures and safety requirements.
- Required heating temperature, soaking time and cooling time are applied and maintained according to standard operating procedure
- Material are heat treated to achieve required result in accordance with standard operating procedures and customer requirements

LO.3 Assure quality and clean up

- Heat treated material is tested for required result in accordance with standard operating procedures
- Work area is cleared and materials are disposed of/or recycled in accordance with legislation and workplace procedures
- Tools and equipment's are cleaned, checked, maintained and stored in accordance with manufacturers' recommendations and workplace procedure
- Documentation is completed in accordance with workplace requirements

Annex: Resource Requirements

IND MCS2 M06 0322 Carrying out Heat Treatment				
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	Herring, Daniel H., A Comprehensive Guide to Heat Treatment, Volumes 1 & 2, e-Books, Industrial Heating/BNP Media, 2018,	5	1:5
3.	Journals/Publication/Magazines	-	-	-
B.	**Learning Facilities & Infrastructure**			
1.	Lecture Room	6mx6m	1	1:25
2.	Library	Standard	1	1:25
3.	Laboratory	Standard	1	1:25
C.	**Consumable Materials**			
1.	A4 paper	A4	5	1:5
2.	Mild steel Ingot	150mmx200mmx 6000mm	As require	1:5
3.	Wood charcoal	50kg	1	1:25
D.	**Tools and equipment's**			
1.	Furnace	Standard	5	1:5

LEARNING MODULE 07
TVET-PROGRAMME TITLE: Mechanics **Level II**
MODULE TITLE: **Performing Hammer Forging**
MODULE CODE: **IND MCS2 M07 0322**
NOMINAL DURATION: **60 Hours**
MODULE DESCRIPTION: This unit covers the knowledge, attitudes and skills required in using hammer tools and formers, selecting material, and applying hammer forging techniques and operation in fabrication and assembly of metals.
LEARNING OUTCOMES At the end of the module the trainee will be able to: **LO1. Analyze and plan hand forging work** **LO2. Prepare and select tools and material** **LO3. Perform hammer forging techniques** **LO4. Assure quality work.**
MODULE CONTENTS: **LO1. Analyze and plan hand forging work** 1.1 Interpreting Drawing for swaging, bending, upsetting, spreading, punching and drifting techniques 1.2 Making Material calculations for oxidization and shrinkage 1.3 Appling forging temperatures and heat specifications. 1.4 Drafting work plan. **LO2. Prepare and select tools and material.** 2.1 Making hammer tools and formers. 2.2 Setting up forging machine. 3.3 Selecting materials. 2.4 Following OHS measures**.** **LO3. Perform hammer forging techniques** 3.1 Selecting and applying hammer forging technique. 3.2 Appling annealing technique. 3.3 Recognizing defects. 3.4 taking appropriate rectification action on defects 3.5 Appling correct techniques to the handling of hot metal

LO4 Assure quality work

4.1 Operating equipment in a manner.

4.2 controlling Heating process

4.3 measuring Form and shape

4.4 following OHS measures and procedures

Learning Methods:				
For none impaired trainees	**Reasonable Adjustment for Trainees with Disability (TWD)**			
	Low Vision	**Deaf**	**Hard of hearing**	**Physical impairment**
Lecture-discussion	❖ 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	❖ 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 ❖ Summarize main points	❖ 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	❖ 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
Demonstration	❖ Conduct close follow up ❖ Use verbal description ❖ Provide special attention in the process of guidance ❖ facilitate the support of peer trainees ❖ Prepare & use simulation	❖ use Sign language interpreter ❖ Use video recorded material ❖ Ensure attention of the trainees ❖ Provide structured training ❖ Show clear and short method ❖ Use gesture ❖ rovide tutorial support (if necessary)	❖ Illustrate in clear & short method ❖ Use Video recorded material ❖ Ensure the attention of the trainees ❖ rovide tutorial support (if necessary)	❖ Facilitate and support the trainees having severe upper limbs impairment to operate equipments/ machines ❖ Assign peer trainees to assist ❖ Conduct close follow up ❖ rovide tutorial support

				(if necessary
Group discussion	❖ 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	❖ Use sign language interpreters ❖ Facilitate the integration of trainees with group members ❖ Conduct close follow up ❖ Introduce the trainees with other group member	❖ Facilitate the integration of trainees with group members ❖ Conduct close follow up ❖ Introduce the trainees with other group member ❖ Inform the group members to speak loudly	❖ Introduce the trainees with their peers
Exercise	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process/practical training ❖ Introduce new and relevant vocabularies	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process/ practical training	❖ Assign peer trainees ❖ Use additional nominal hours if necessary
Individual assignment	❖ 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	❖ Use sign language interpreter ❖ Provide briefing /orientation on the assignment ❖ Provide visual recorded material	❖ Provide briefing /orientation on the assignment ❖ Provide visual recorded material	

ASSESSMENT METHODS:				
Interview		❖ 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	❖ Speak loudly ❖ Using sign language interpreter if necessary	❖ Use written response as an option for the trainees having speech challenges
Written test	❖ 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	❖ Prepare the exam using short sentences, multiple choices, True or False, matching and short answers ❖ Avoid essay writing ❖ Time extension	❖ Prepare the exam using short sentences, multiple choices, true or false, matching and short answers if necessary.	❖ 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 ❖ Time extension	❖ Use sign language interpreter ❖ Brief on the instruction of the exam ❖ Provide activity-based/ practical assessment method ❖ Time extension	❖ Provide activity based assessment ❖ Brief on the instruction of the exam ❖ Use loud voice ❖ Time extension	❖ Provide activity based assessment ❖ Conduct close follow up ❖ Time extension

ASSESSMENT CRITERIA:

LO.1 Analyze and plan hand forging work

- Drawing is interpreted for swaging, bending, upsetting, spreading, punching and drifting techniques is in compliance with specification.
- Material calculations are made using volumes and weights that include provision for oxidization and shrinkage
- Forging temperatures and heat specifications are applied to for various materials requirement
- Work plan is drafted according to specifications

LO.2 Prepare and select tools and material

- Hammer tools and formers are made available according to operational procedures
- Forging machine is setup in accordance with operational procedures
- Material is correctly selected for use with specific tools and formers with compliance to standards
- OHS measures are followed throughout the application of this unit based on requirements

LO.3 Perform hammer forging techniques

- Appropriate hammer forging technique is selected and applied according to standard
- Annealing technique is applied with compliance to instructions
- Defects are recognized and appropriate rectification action is taken based on operational procedures
- Correct techniques are applied to the handling of hot metal with regard to balancing and pivoting due to operational instruction
- Correct heating process is applied based on operational instructions

LO4 Assure quality work

- Equipment is operated in a manner that minimizes oxidization in accordance with operational procedures
- Heating process is controlled to specified areas as per instruction
- Form and shape are measured applying standard device
- OHS measures and procedures are followed throughout the process.

IND MCS2 M07 0322 Performing Hammer Forging				
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	-Hammer forging process by Metalurgija-sisak then Zagreb 2013	5	1:5
3.	Journals/Publication/Magazines	-	-	-
B.	**Learning Facilities & Infrastructure**			
1.	Lecture Room	6mx6m	1	1:25
2.	Library	Standard	1	1:25
3.	Workshop	Standard	1	1:25
C.	**Consumable Materials**			
1.	A4 Paper	Packet	5	1:5
2	Round bar	Dia.100mmx6000mm	As required	1:5
D.	**Tools and equipment's**			
1.	Flatters,	STD	5	1:5
2	Swages	STD	5	1:5
3	Sledge hammers	STD	5	1:5
4	Hot/cold sets.	STD	5	1:5
5	Anvil.	STD	5	1:5
6	Tong.	STD	10	1:5
7	Drop hammer, Hydraulic press	STD	5	1:5

LEARNING MODULE 08
TVET-PROGRAMME TITLE: **Mechanics Level II**
MODULE TITLE: **Performing basic foundry**
MODULE CODE: **IND MCS2 M08 0322**
NOMINAL DURATION: **50 Hours**
MODULE DESCRIPTION: This module covers the skills, knowledge and attitudes required to manual making (jobbing) of sand moulds for metal casting typically in a working foundry. Moulds are made by using single piece patterns. Fabrication from specifications, instructions or drawings.
LEARNING OUTCOMES At the end of the module the trainee will be able to: **LO1. Identify job requirements and Sequence of operation** **LO2. Select and prepare patterns, hand tools and equipment** **LO3. Make mould** **LO4. Clean and restore work area**
MODULE CONTENTS: **LO1. Identify job requirements and Sequence of operation** 1.1 Identifying Job requirements. 1.2 Selecting Material. 1.3 Determining Sequence of operation including job set up. **LO2. Select and prepare patterns, hand tools and equipment** 2.1 Identifying Pattern equipment. 2.2 Inspecting Pattern equipment and identifying damaged patterns. 2.3 Assembling Pattern. 2.4 Setting up Pattern equipment. **LO3. Make mould** 3.1 Closing and checking Mould. 3.2 Selecting and positioning appropriate molding equipment 3.3 Selecting appropriate molding media to produce mould. 3.4 Securing mould. 3.5 Selecting or manufacturing Pouring basin and positioning. 3.6 Ramming up mould properly and striking off. 3.7 Utilizing Parting and stripping systems.

3.8 Positioning and securing loose pieces, vents, risers and runners.

3.9 Removing Pattern and loose pieces from mould.

3.10 Cleaning and painting mould and core

LO4. Clean and restore work area

4.1 Clearing all materials/debris and cleaning work site.

4.2 Disposing unwanted treated sand.

Learning Methods:				
For none impaired trainees	**Reasonable Adjustment for Trainees with Disability (TWD)**			
	Low Vision	**Deaf**	**Hard of hearing**	**Physical impairment**
Lecture-discussion	❖ 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	❖ 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 ❖ Summarize main points	❖ 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	❖ 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
Demonstration	❖ Conduct close follow up ❖ Use verbal description ❖ Provide special attention in the process of guidance ❖ facilitate the support of peer trainees ❖ Prepare & use simulation	❖ use Sign language interpreter ❖ Use video recorded material ❖ Ensure attention of the trainees ❖ Provide structured training ❖ Show clear and short method ❖ Use gesture ❖ rovide tutorial support (if necessary)	❖ Illustrate in clear & short method ❖ Use Video recorded material ❖ Ensure the attention of the trainees ❖ rovide tutorial support (if necessary)	❖ Facilitate and support the trainees having severe upper limbs impairment to operate equipments/ machines ❖ Assign peer trainees to assist ❖ Conduct close follow up ❖ rovide tutorial support (if necessary
Group discussion	❖ 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	❖ Use sign language interpreters ❖ Facilitate the integration of trainees with group members ❖ Conduct close follow up ❖ Introduce the trainees with other group member	❖ Facilitate the integration of trainees with group members ❖ Conduct close follow up ❖ Introduce the trainees with other group member ❖ Inform the group members to speak loudly	❖ Introduce the trainees with their peers

Exercise	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process/practical training ❖ Introduce new and relevant vocabularies	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process/ practical training	❖ Assign peer trainees ❖ Use additional nominal hours if necessary
Individual assignment	❖ 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	❖ Use sign language interpreter ❖ Provide briefing /orientation on the assignment ❖ Provide visual recorded material	❖ Provide briefing /orientation on the assignment ❖ Provide visual recorded material	
ASSESSMENT METHODS:				
Interview		❖ 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	❖ Speak loudly ❖ Using sign language interpreter if necessary	❖ Use written response as an option for the trainees having speech challenges
Written test	❖ 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	❖ Prepare the exam using short sentences, multiple choices, True or False, matching and short answers ❖ Avoid essay writing ❖ Time extension	❖ Prepare the exam using short sentences, multiple choices, true or false, matching and short answers if necessary.	❖ 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 ❖ Time extension	❖ Use sign language interpreter ❖ Brief on the instruction of the exam ❖ Provide activity-based/ practical assessment method ❖ Time extension	❖ Provide activity based assessment ❖ Brief on the instruction of the exam ❖ Use loud voice ❖ Time extension	❖ Provide activity based assessment ❖ Conduct close follow up ❖ Time extension

ASSESSMENT CRITERIA:

LO1. Identify job requirements and Sequence of operation

- Job requirements are correctly identified from drawings, instructions and specifications
- Material is selected appropriate to job requirements
- Sequence of operation including job set up is determined for maximum safety, efficiency and to meet job specifications

LO2. Select and prepare patterns, hand tools and equipment

- Pattern equipment is correctly identified from specifications to standard operating procedures
- Pattern equipment is inspected to specifications, and damaged patterns are identified for repair or replacement to standard operating procedures
- Pattern is assembled to specification
- Pattern equipment is set up to specification according to standard operating procedures

LO3. Make mould

- Mould is closed and checked for compliance to component specification in accordance with standard operating procedures
- Appropriate molding equipment is selected and positioned according to standard operating procedures
- Appropriate molding media is selected to produce mould to specification
- Mould is secured according to standard operating procedures
- Pouring basin is selected or manufactured to specification and positioned in accordance with standard operating procedures
- Mould is rammed up properly with joints and strikes off as required to standard operating procedures
- Parting and stripping systems are utilized in accordance with standard operating procedures
- Loose pieces, vents, risers and runners are positioned and secured as required to standard operating procedures
- Pattern and loose pieces are removed from mould in a safe manner least likely to cause damage to the pattern and in accordance with standard operating procedures
- Mould and core is cleaned and painted according to specification using standard operating procedures

LO4. Clean and restore work area

- All materials/debris is cleared and work site cleaned and left in a safe state
- Unwanted treated sand is disposed of according to standard operating procedures.

Annex: Resource Requirements

IND MCS2 08 0322 Performing basic foundry				
Item No.	**Category/Item**	**Description/ Specifications**	**Quantity**	**Recommended Ratio (Item: Trainee)**
A.	**Learning Materials**			
1.	TTLM	TTTLM prepared by the trainer		
2.	Reference Books	-Foundry technology by O.P.Khanna -Principles of Foundry technology by P.L.Jain -G S Upadhyaya, Powder Metallurgy Technology, 1996	5	1:5
3.1	Textbooks			
4.	Journals/Publication/Magazines			
B.	**Learning Facilities & Infrastructure**			
1.	Lecture Room	6*8m	1	1:25
2.	Machine shop	10x15m	1	1:25
3.	Library	20x20	1	1:25
C.	**Consumable Materials**			
1.	Aluminum scrap		15 kg	1:25
2	Lead scrap		10 kg	1:25
3	Molding sand/Green sand	STD	1	!:5
D.	**Tools and Equipments**			
1.	Shovel	STD	5	1:5
2	Hand Riddle	Standard	5	1:5
3	Sand Mixer	Standard	1	1:25
4	Plated patterns			1:5
5	Split patterns			1:5
6	Cutting tools - hacksaw, crosscut saw, rip saw	STD	25	1:1

7	Boring tools - auger, brace, gimlet, hand drill	STD	5	1:5
8	Holding tools - vice grip, C-clamp, bench vice	STD	5	1:5
9	Threading tools - die and stock, taps	STD	5	1:5
10	Measuring instruments	STD	25	1:1
11	Wood lathe	STD	5	1:5
12	Disk sander	STD	5	1:5
13	Woods for Molds and pattern	STD	As required	
14	Molding Machine,	STD	5	1:5

LEARNING MODULE 09
TVET-PROGRAMME TITLE: **Mechanics Level II**
MODULE TITLE: **Performing Equipment/Machine Layout, Setting and Leveling**
MODULE CODE: **IND MCS2 M09 0322**
NOMINAL DURATION: **50 Hours**
MODULE DESCRIPTION: This module covers the skills, knowledge and attitudes needed to prepare layout for equipment foundation, setting and undertaking leveling and alignment tasks of machines and equipment in industry application.
LEARNING OUTCOMES At the end of the module the trainee will be able to: **LO1. Plan and prepare work** **LO2. Perform layout** **LO3. Perform setting and leveling and alignment** **LO4. Assure quality and Clean up**
MODULE CONTENTS: **LO1. Plan and prepare work** 1.1. Obtaining and correctly interpreting work instructions. 1.2. Following Safety Occupational Health and Safety (OHS) requirements. 1.3. Selecting Tools and equipment. 1.4. Calculating material quantity 1.5. Selecting and setting up correct and appropriate leveling or alignment devices 1.6. Identifying electrical lightings and wirings/gadgets for installation 1.7. Identifying and applying environmental protection requirements. **LO2. Perform layout** 2.1. Inspecting shop area for proper placement of equipment / machine 2.2. Taking flow of equipment, material or personnel. 2.3. Doing layout of equipment in workshop. 2.4. Marking locations for form works, anchor bolts, etc. 2.5. Clearing and surface preparing work area for safe erection of formwork. **LO3.** Perform setting and leveling and alignment 3.1. Setting machine. 3.2. Adjusting machine.
3.3. Leveling equipment.

3.4. Completing leveling and alignment task.

LO4. Assure quality and Clean up

4.1. Measuring first-off samples

4.2. Preparing and completing all reports and documentation

4.3. Clearing work area and disposing of, reusing or recycling materials.

4.4. Checking, cleaning, oiling, maintaining and storing Plant, 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	❖ 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	❖ 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 ❖ Summarize main points	❖ 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	❖ 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
Demonstration	❖ Conduct close follow up ❖ Use verbal description ❖ Provide special attention in the process of guidance ❖ facilitate the support of peer trainees ❖ Prepare & use simulation	❖ use Sign language interpreter ❖ Use video recorded material ❖ Ensure attention of the trainees ❖ Provide structured training ❖ Show clear and short method ❖ Use gesture ❖ rovide tutorial support (if necessary)	❖ Illustrate in clear & short method ❖ Use Video recorded material ❖ Ensure the attention of the trainees ❖ rovide tutorial support (if necessary)	❖ Facilitate and support the trainees having severe upper limbs impairment to operate equipments/ machines ❖ Assign peer trainees to assist ❖ Conduct close follow up ❖ rovide tutorial support (if necessary
Group discussion	❖ 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	❖ Use sign language interpreters ❖ Facilitate the integration of trainees with group members ❖ Conduct close follow up ❖ Introduce the trainees with other group member	❖ Facilitate the integration of trainees with group members ❖ Conduct close follow up ❖ Introduce the trainees with other group member ❖ Inform the group members to speak loudly	❖ Introduce the trainees with their peers

Exercise	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process/practical training ❖ Introduce new and relevant vocabularies	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process/ practical training	❖ Assign peer trainees ❖ Use additional nominal hours if necessary
Individual assignment	❖ 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	❖ Use sign language interpreter ❖ Provide briefing /orientation on the assignment ❖ Provide visual recorded material	❖ Provide briefing /orientation on the assignment ❖ Provide visual recorded material	

ASSESSMENT METHODS:

Interview		❖ 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	❖ Speak loudly ❖ Using sign language interpreter if necessary	❖ Use written response as an option for the trainees having speech challenges
Written test	❖ 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	❖ Prepare the exam using short sentences, multiple choices, True or False, matching and short answers ❖ Avoid essay writing ❖ Time extension	❖ Prepare the exam using short sentences, multiple choices, true or false, matching and short answers if necessary.	❖ 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 ❖ Time extension	❖ Use sign language interpreter ❖ Brief on the instruction of the exam ❖ Provide activity-based/ practical assessment method ❖ Time extension	❖ Provide activity based assessment ❖ Brief on the instruction of the exam ❖ Use loud voice ❖ Time extension	❖ Provide activity based assessment ❖ Conduct close follow up ❖ Time extension

LO1. Plan and prepare work

- Work instructions, including plans, specifications, quality requirements and operational details are obtained and correctly interpreted compliant to task
- Safety **Occupational Health and Safety (OHS)requirements** are followed in accordance with safety plans and policies
- Tools and equipment are selected to the need of particular job with compliance to operational procedures
- Material quantity requirements are calculated in accordance with plans and/or **specifications**
- Correct and appropriate leveling or alignment devices/ equipment are selected and set up to standard operating procedures
- Electrical lightings, wirings/gadgets are identified for proper installation of equipment/machine in accordance with standards
- Environmental protection requirements are identified and applied for the project in accordance with environmental plans and regulatory obligations

LO2. Perform layout

- Shop area is inspected for proper placement of equipment / machine based on manuals
- Flow of equipment, material or personnel is taken into consideration for safety reason and movability according to operational procedures
- Layout of equipment is done in workshop taking into consideration of its load, vibration and other parameters based on machine specifications
- Locations are marked for form works, anchor bolts, etc. based on plans and instructions
- Work area is cleared and surface prepared for safe erection of formwork according to requirements

LO3. Perform setting and leveling and alignment

- Machine is set in accordance with defined procedures
- Machine is adjusted to meet specifications and operational requirements
- Equipment are leveled to specifications using correct and appropriate techniques according to standard
- Leveling and alignment task is completed to specifications.

LO4. Assure quality and Clean up

- First-off samples are measured in compliance with specifications

- All reports and documentation are prepared and completed correctly based on standard procedures and format.
- Work area is cleared and materials are disposed of, reused or recycled in accordance with legislation/regulations/codes of practice
- Plant, **tools and equipment** are checked, cleaned, oiled, maintained and stored in accordance with manufacturers' recommendations

Annex: Resource Requirements

IND MCS2 09 0322 **Performing Equipment/Machine Layout, Setting and Leveling**				
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.	Textbooks			
3.	Reference Books	-Heragu S.S. Facility design, 1st edition, universe Inc., New York, 1997 Design of Components and Layout of Machines for Material Handling J Adv Manuf Technol (2001) Springer	5	1:5
4.	Journals/Publication/Magazines			
B.	**Learning Facilities & Infrastructure**			
1.	Lecture Room	6*8m	1	1:25
2.	Machine shop	7x5m	1	1:25
3.	Library	20x20	1	1:25
C.	**Consumable Materials**			
1.	Cement	100kg	5	1:5
2	Leather Glove	STD	25	1:1
3	Water			
4	Sand		As required	1:5
D.	**Tools and Equipments**			
1.	Hand tools and safety tools & equipments	STD	5	1:5
2	Hand held power tools	STD	5	1:5
3	Measuring tapes	STD	5	1:5

4	spirit levels	STD	5	1:5
5	Dial indicators	STD	2	1:5
6	magnetic bases	STD	5	1:5
7	feeler gauges	STD	5	1:5
8	Bench centers	STD	5	1:5
9	V- blocks	STD	5	1:5
10	line levels	STD	5	1:5
11	optical levels	STD	5	1:5
12	electronic levels	STD	1	1:5

LEARNING MODULE 10
TVET-PROGRAMME TITLE: **MECHANICS Level II**
MODULE TITLE: **Installing and Maintaining Fluid Power Pipes and Tubes**
MODULE CODE: **IND MCS2 M10 0322**
NOMINAL DURATION: **60 Hours**
MODULE DESCRIPTION: This module covers competence required to perform fluid power pipes and tubes installation, maintenance and repair to pumps, equipment and machineries.
LEARNING OUTCOMES At the end of the module the trainee will be able to: **LO1. Identify and plan work** **LO2. Prepare and set-up work** **LO3**: **Install fluid power pipes and tubes** **LO4**: **Assure quality and cleanup work**
MODULE CONTENTS: **LO1. Identify and plan work** 1.1. Obtaining, confirming and applying Work instructions 1.2. Applying The site safety plan and organizational requirements based on OHS standards 1.3. Identifying Quantity and type of components, tools and equipment **LO2. Prepare and set-up work** 2.1. Identifying Faults 2.2. Identifying and applying Potential methods of repairing fault 2.3. Identifying Types of pipes and fittings 2.4. Selecting Appropriate tools and equipment 2.5. Mapping out Circuit functions and components in suitable graphical diagrams **LO3 Install fluid power pipes and tubes** 3.1. Lowering and placing Pipes in position 3.1.1. Sizing of pipes 3.1.2. Mains pipe systems and installation procedures 3.2. Joining Pipes 3.3. Installing Pipe system 3.4. Conducting repair **LO4**: **Assure quality and cleanup work** 4.1. Flushing and pressure testing components 4.2. Completing Test reports accordance with environmental protection requirement 4.3. Clearing Work area, tools materials and equipment's

Learning Methods:				
For none impaired trainees	**Reasonable Adjustment for Trainees with Disability (TWD)**			
	Low Vision	**Deaf**	**Hard of hearing**	**Physical impairment**
Lecture-discussion	❖ 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	❖ 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 ❖ Summarize main points	❖ 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	❖ 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
Demonstration	❖ Conduct close follow up ❖ Use verbal description ❖ Provide special attention in the process of guidance ❖ facilitate the support of peer trainees ❖ Prepare & use simulation	❖ use Sign language interpreter ❖ Use video recorded material ❖ Ensure attention of the trainees ❖ Provide structured training ❖ Show clear and short method ❖ Use gesture ❖ rovide tutorial support (if necessary)	❖ Illustrate in clear & short method ❖ Use Video recorded material ❖ Ensure the attention of the trainees ❖ rovide tutorial support (if necessary)	❖ Facilitate and support the trainees having severe upper limbs impairment to operate equipments/ machines ❖ Assign peer trainees to assist ❖ Conduct close follow up ❖ rovide tutorial support (if necessary
Group discussion	❖ 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	❖ Use sign language interpreters ❖ Facilitate the integration of trainees with group members ❖ Conduct close follow up ❖ Introduce the trainees with other group member	❖ Facilitate the integration of trainees with group members ❖ Conduct close follow up ❖ Introduce the trainees with other group member ❖ Inform the group members to speak loudly	❖ Introduce the trainees with their peers

Exercise	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process/practical training ❖ Introduce new and relevant vocabularies	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process/ practical training	❖ Assign peer trainees ❖ Use additional nominal hours if necessary
Individual assignment	❖ 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	❖ Use sign language interpreter ❖ Provide briefing /orientation on the assignment ❖ Provide visual recorded material	❖ Provide briefing /orientation on the assignment ❖ Provide visual recorded material	

ASSESSMENT METHODS:				
Interview		❖ 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	❖ Speak loudly ❖ Using sign language interpreter if necessary	❖ Use written response as an option for the trainees having speech challenges
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Demonstration/Observation	❖ Brief the instruction or provide them in large text ❖ Time extension	❖ Use sign language interpreter ❖ Brief on the instruction of the exam ❖ Provide activity-based/ practical assessment method ❖ Time extension	❖ Provide activity based assessment ❖ Brief on the instruction of the exam ❖ Use loud voice ❖ Time extension	❖ Provide activity based assessment ❖ Conduct close follow up ❖ Time extension

ASSESSMENT CRITERIA:

LO1. Identify and plan work

- Work instructions, including plans, specifications, quality requirements and operational details relevant to the tasks are obtained, confirmed and applied based on operational procedures
- The site safety plan and organizational requirements are applied based on the Occupational Health and Safety (OHS)standards
- Quantity and type of components, tools and equipment required are identified from given drawings and in accordance with manufacturer specifications

LO2. Prepare and set-up work

- Faults are identified that will prevent the component operating as required due to operational procedures
- Potential methods of repairing the fault are identified and applied to ensure compliance of the component with manufacturer specifications
- Types of pipes and fittings identified are made appropriate to the required flow speed and pressure based on the required specifications
- Appropriate tools and equipment are selected according to working procedures
- Circuit functions and components are mapped out in suitable graphical diagrams according to standards

LO3 Install fluid power pipes and tubes

- Pipes are lowered and placed in position to design specifications
- Pipes are joined in accordance with manufacturers' specifications
- Pipe system is installed in accordance with plans, specifications and standards
- The repair is conducted in accordance with accepted timeframes and with minimum wastage

LO4: **Assure quality and cleanup work**

- Components installed, repaired or maintained are flushed and pressure tested based on work specifications
- Test reports are completed in accordance with environmental protection requirement
- Work area, tools and equipment are cleared and materials and types are disposed of, reused or recycled in accordance with legislation/ regulations/codes of practice and job

Annex: Resource Requirements

IND MCS2 M10 0322 Installing and Maintaining Fluid Power Pipes and Tubes				
Item No.	Category/Item	Description/ Specifications	Quantity	Recommended Ratio (Item: Learner)
A.	**Learning Materials**			
1.	TTLM	Prepared by trainer's	25	1:1
2.	Textbooks			
3.	Reference Books	-Fluid Power Edited by Mary Gannon and Richard Schneider, Hydraulics & Pneumatics magazine. 2018	5	1:5
4.	Journals/Publication/Magazines			
B.	**Learning Facilities & Infrastructure**			
1.	Lecture Room	5*5m	1	1:25
2.	Library	STD	1	1:25
3.	Laboratory	STD	1	1:25
C.	**Consumable Materials**			
1	Fluid (air, oil)	STD		
D.	**Tools and Equipment**			
1	Leveling equipment,	STD	5	1:5
2	Hydraulic and pneumatic joints , fittings and seals	STD		1:5
3	Pressure gauges	STD	set	1:5
4	Leakage detector	STD	set	1:5
5	Soldering and brazing tools	STD	set	1:5
6	Pipe cutter	STD	5	1:5
7	Pipe wrenches	STD	5	1:5
8	Pipe threaded	STD	5	1:5
9	Tapes	STD	set	1:5

Acknowledgement

The **Ministry of Labor and Skills** wishes to thank and appreciation for the trainers who donated their effort and time to develop this outcome based curriculum for the TVET program mechanics Level I. We also thank all regional TVET College, Trainers, coordinators and Federal TVET institute programmers for active facilitation for the development of this curriculum.

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