MECHANICS
LEVEL – III

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 III**.**

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 III

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_Perform Engineering Detail Drafting by using CAD, Perform Geometric Development, Perform Gas Metal Arc Welding (GMAW), Perform Gas Tungsten Arc Welding (GTAW), Perform Manual and precisions Assembly, Perform Machine, equipment Plant Installation and commission, Maintain and Repair Industrial Electrical Machines drive and Components, Install and Maintain Basic Pneumatic and Hydraulic Systems, Install Electrical Measuring Instruments and Control Devices and Apply protective coatings 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 MCS3 01 1221 Perform Engineering Detail Drafting by using CAD

IND MCS3 02 1221 Perform Geometric Development

IND MCS3 03 1221 Perform Gas Metal Arc Welding (GMAW)

IND MCS3 04 1221 Perform Gas Tungsten Arc Welding (GTAW)

IND MCS3 05 1221 Perform Manual and precisions Assembly

IND MCS3 06 1221 Perform Machine, equipment Plant Installation and commission

IND MCS3 07 1221 Maintain and Repair Industrial Electrical Machines drive and Components

IND MCS3 08 1221 Install and Maintain Basic Pneumatic and Hydraulic Systems

IND MCS3 09 1221 Install Electrical Measuring Instruments and Control Devices

IND MCS3 10 1221 Apply protective coatings.

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.	Perform Engineering Detail Drafting by using CAD	20	40	20	80	
2.	Perform Geometric Development	20	30	10	60	
3.	Perform Gas Metal Arc Welding (GMAW)	20	40	20	80	
4.	Perform Gas Tungsten Arc Welding (GTAW)	20	40	20	80	
5.	Perform Manual and precisions Assembly	20	10	20	50	
6.	Perform Machine, equipment Plant Installation and commission	20	10	20	50	
7.	Maintain and Repair Industrial Electrical Machines drive and Components	30	10	20	60	
8.	Install and Maintain Basic Pneumatic and Hydraulic Systems	30	10	20	60	
9.	Install Electrical Measuring Instruments and Control Devices	20	10	20	50	
10.	Apply protective coatings	20	10	10	40	
	Total Hrs	220	210	180	**610 Hrs**	

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 III**.**

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.

1.5. 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 Outcomes	Duration (In Hours)
IND MCS3 01 1221	Perform Engineering Detail Drafting by using CAD	**IND MCS3 M01 0322**	Performing Engineering Detail Drafting by using CAD	• Determine drawing requirements • Prepare assembly, lay-out and detail drawing • Check drawing	80
IND MCS3 02 1221	Perform Geometric Development	**IND MCS3 M02 0322**	Performing Geometric Development	• Mark off/out fabrications • Make templates as required • Develop patterns as required • Estimate quantities of materials from detail drawings	60
IND MCS3 03 1221	Perform Gas Metal Arc Welding (GMAW)	**IND MCS3 M03 0322**	Performing Gas Metal Arc Welding (GMAW)	• Prepare materials for Gas Metal Arc Welding (GMAW) • Select and assemble welding machine / equipment • Minimize and rectify distortion • Weld to job specification using GMAW • Ensure weld conformance	80
IND MCS3 04 1221	Perform Gas Tungsten Arc Welding (GMAW)	**IND MCS3 M04 0322**	Performing Gas Tungsten Arc Welding (GMAW)	• Prepare materials for Gas Tungsten Arc Welding (GTAW) • Select and assemble welding machine / equipment • Minimize and rectify distortion • Weld to job specification using GTAW • Ensure weld conformance	80
IND MCS3 05 1221	Perform Manual and precisions Assembly	**IND MCS3 M05 0322**	Performing Manual and precisions Assembly	• Prepare for work • Assemble engineering components	50

				• Assure quality assembled items	
IND MCS3 06 1221	Perform Machine, equipment Plant Installation and commission	**IND MCS3 M06 1221**	Performing Machine, equipment Plant Installation and commission	• Prepare installation site • Install machine/ plant • Assure quality installation work	50
IND MCS3 07 1221	Maintain and Repair Industrial Electrical Machines drive and Components	**IND MCS3 M07 0322**	Maintaining and Repairing Industrial Electrical Machines drive and Components	• Determine plan, prepare coordinate maintenance and repair work • Maintain and repair electrical drive system and components • Manufacture spare parts/ components • Assure quality maintained or repaired components	60
IND MCS3 08 1221	Install and Maintain Basic Pneumatic and Hydraulic Systems	**IND MCS3 M08 0322**	Installing and Maintaining Basic Pneumatic and Hydraulic Systems	• Plan and Prepare work • Install basic pneumatic and hydraulic circuits • Test and repair components and circuits • Assure quality and maintain work	60
IND MCS3 09 1221	Install Electrical Measuring Instruments and Control Devices	**IND MCS3 M09 0322**	Installing Electrical Measuring Instruments and Control Devices	• Plan and Prepare Installation work • Install instrumentation and control devices • Assure quality instrumentation and control devices • Clean-up	50

IND MCS3 10 1221	Apply protective coatings	**IND MCS3 M10 0322**	Applying protective coatings	• Determine job requirements • Prepare work piece for protective coating • Prepare equipment for surface coating materials • Apply single pack coatings • Clean and store equipment • Inspect finish surface • Select and maintain personal protective equipment (PPE)	40
					610 Hrs

*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 III**
MODULE TITLE: **Performing Engineering Detail Drafting by using CAD**
MODULE CODE: **IND MCS3 M01 0322**
NOMINAL DURATION: **80 Hours**
MODULE DESCRIPTION: This unit covers skill, knowledge and attitudes required in producing drawings components complete with surface texture and dimensions using manual drafting and CAD system. Drawing components may include assembly, layout and detail drawings.
LEARNING OUTCOMES At the end of the module the trainee will be able to: **LO1.** Determine drawing requirements **LO2.** Prepare assembly, lay-out and detail drawing **LO3**. Check drawing
MODULE CONTENTS: **LO1. Determine drawing requirements** 1.1. Checking and interpreting drawing 1.2. Gathering information from workshop manuals, customer specifications 1.3. Planning scope of drawing **LO2. Prepare assembly, lay-out and detail drawing** 2.1. Determining specifications and detail drawing 2.2. Undertaking engineering calculations including limits and fits, 2.3. Inserting dimensions and geometric tolerance 2.4. Showing correct convention 2.5. Producing drawings using CAD in third angle projection 2.6. Producing all drawing auxiliary views, sections and assemblies 2.7. Selecting materials from data sheet **LO3. Check drawing** 3.1. Checking drawing with specification 3.2. Checking assembly/fabrication drawing 3.3. Filing and storing drawing

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 Determine drawing requirements

- Requirements and purpose of **drawing** are checked and interpreted from work order or similar.
- Required information is sourced from workshop manuals, customer specifications, product suppliers, and designers or similar.
- Scope of drawing including layout, additional required information and resources are planned.

LO.2 Prepare assembly, lay-out and detail drawing

- Drawing details and specifications are determined.
- Engineering calculations are undertaken to determine all dimensions including limits and fits, surface texture, datum references and geometric tolerances where appropriate to ensure functional operation and suitability
- Dimensions and **geometric tolerances** of various components are inserted where required.
- **Appropriate symbols** for **limits and fits**, surface texture and geometric tolerances are included.
- Correct convention of parts is shown.
- Drawing is produced by using **CAD** in third angle projection, including auxiliary views, sections and assemblies
- All drawings are produced in an accordance to manufacturers specifications
- Components, material and/or assemblies are selected from data sheets or manufacturers' catalogues to meet specifications.

LO.3 Check drawing

- Drawings are checked to ensure compliance with specifications.
- Drawings are checked to ensure that assembly/fabrication is possible.
- Drawings are issued, filed and stored according to workplace system and procedures.

Annex: Resource Requirements

IND MCS3 M01 0322 Perform Engineering Detail Drafting by using CAD				
Item No.	**Category/Item**	**Description/ Specifications**	**Quantity**	**Recommended Ratio (Item: Trainee)**
A.	**Learning Materials**			
1.	TTLM	TTTLM prepared by the trainer	25	1:25
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
3.1	Textbook,	›		
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	CAD Software,		1	1:25
3	Hard disk,	-	-	-
4	Printer		1	1:25

LEARNING MODULE 02
TVET-PROGRAMME TITLE: **MECHANICS Level III**
MODULE TITLE: **Performing Geometric Development**
MODULE CODE: **IND MCS3 M02 0322**
NOMINAL DURATION**: 60 Hours**
MODULE DESCRIPTION: This unit covers skill, knowledge and attitudes required in marking out complex cylindrical/ rectangular, conical and transitions fabrications using advanced geometric development techniques. It reflects the advanced skills required to calculate cutting, bending lines and developments. Fabrications may include elliptical shapes, curves, spirals etc. Patterns may include complex and irregular shapes.
LEARNING OUTCOMES At the end of the module the trainee will be able to: **LO1.Mark off/out fabrications** **LO2.Make templates as required** **LO3.Develop patterns as required** **LO4.Estimate quantities of materials from detail drawings**
MODULE CONTENTS: **LO1. Mark off/out fabrications** 1.1 Determining work requirements and specifications 1.2 Carrying out development using appropriate tools and equipment 1.3 Establishing and indicating correcting datum points 1.4 Determining Allowances **LO2. Make templates as required** 2.1. Selecting template materials 2.2. Determining and transferring allowance 2.3. Producing templates for rolling, bending, pressing, drilling and profiling 2.4. Following correct storage procedures including labeling 2.5. Utilizing appropriate tools and equipment **LO3. Develop patterns as required** 3.1. Choosing appropriate development method 3.2. Determining and transferring Allowances 3.3. Interpreting and applying standards/codes and symbols 3.4. Developing patterns 3.5. Using Appropriate tools and equipment **LO4. Estimate quantities of materials from detail drawings** 4.1. Identifying materials 4.2. Estimating quantities 4.3. Minimizing Material wastage 4.4. Reporting bill of material

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 Mark off/out fabrications

- Specifications and work requirements are determined using correct calculations appropriate to the task.
- Development is carried out to specifications or standard operating procedures using tools and equipment appropriate to the task.
- Datum points are correctly established and indicated.
- **Allowances** are correctly determined and marked

LO.2 Make templates as required

- Template material is selected appropriate to the marking out requirements.
- Templates are accurately produced.
- Allowances are correctly determined and transferred.
- Templates for rolling, bending, pressing, drilling and profiling are accurately produced following OHS procedures.
- Correct storage procedures are followed including labeling and identification to standard operating procedures.
- Appropriate tools and equipment are utilized throughout the process

LO.3 Develop patterns as required

- Most appropriate development method for the task is chosen and applied.
- Allowances are correctly determined and transferred.
- Relevant standards/codes and symbols are interpreted and applied to materials and processes
- Developed patterns are ensured to comply with job specifications and work standards
- Appropriate tools and equipment are utilized in the preparation of patterns

LO.4 Estimate quantities of materials from detail drawings

- Materials are correctly identified.
- Quantities are estimated from drawings.
- Material use is optimized and wastage is minimized
- Bill of materials is documented and reported/submitted to appropriate personnel following organization format and standards

Annex: Resource Requirements

IND MCS3 M02 0322 Performing Geometric Development				
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. HajraChoudhory C.J., "Elements of workshop Technology ", Vol. I to Vol. III, Asia Publishing House, 1992. 2. Schey, John A., "Introduction to Manufacturing Processes",	5	1:5

		McGraw Hill, Second Edition, 1987. 3 Engineering Drawing N.D BHATT, 5th edition Geometric development San foundry Aug 12,2013		
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.	Soft paper	Mamco	5 Pack	1:5
2.	Hard (model) paper and bond paper	(A4, A3, A2, A1)	5pack	1:5
3	Sheet metal	Gauge 0.8-1mm	25	1:1
4	Paper glue	UHU	As required	1:5
D.	**Tools and Equipments**			
1	Steel rule	30-50cm	25	1:1
2	Ball peen Hammer	2kgs.	25	1:1
3	Mallet hammer	Plastic	25	1:1
4	Divider	STD	25	1:1
5	Try square	STD	25	1:1
6	Snip	STD	25	1:1
7	Bench shear	STD	5	1:5
8	Folding machine	STD	5	1:5
9	Drilling machine	STD	5	1:5
10	Arc Welding machine	STD	5	1:5
11	Bench shear	STD	5	1:5
12	Rivet gun & rivet	STD	5	1:5

LEARNING MODULE 03
TVET-PROGRAMME TITLE: Mechanics **Level III**
MODULE TITLE: **Performing Gas Metal Arc Welding (GMAW)**
MODULE CODE: **IND MCS3 M03 0322**
NOMINAL DURATION: **80 Hours**
MODULE DESCRIPTION: This module covers the knowledge, attitudes and skills required in preparing materials, selecting and setting up the welding equipment, carrying out the Gas Metal Arc Welding (GMAW) and inspecting and correcting defects in fabrication and assembly of metals.
LEARNING OUTCOMES At the end of the module the trainee will be able to: **LO1. Prepare materials for Gas Metal Arc Welding (GMAW)**

LO2. Select and assemble welding machine / equipment
LO3. Minimize and rectify distortion
LO4. Weld to job specification using GMAW
LO5.Ensure weld conformance

MODULE CONTENTS:

LO1. Prepare materials for Gas Metal Arc Welding (GMAW)
1.1 Identifying Weld requirements
1.2 Preparing materials
1.3 Assembling /aligning materials.

LO2. Select and assemble welding machine / equipment
2.1 Selecting and making tools and equipment
2.2 Identifying welding machine settings, accessories and consumables.
2.3 Positioning welding machine
2.4 Assembling and setting-up welding equipment
2.5 Fine-tuning or adjusting current, voltage, and wire feed settings
2.6 Wiring up or set welding machine to the polarity
2.7 Identifying types of gases and their uses
2.8 Welding codes
2.9 Weld carbon steel pipes using MIG in 2G and 5G and/or 6G positions

LO3. Minimize and rectify distortion
3.1 Selecting distortion prevention measures
3.2 Rectifying distortion.
3.3 Observing OHS procedures.

LO4 Weld to job specification using GMAW
4.1 Performing root pass
4.2 Cleaning root pass.
4.3 Performing subsequent filling passes.
4.4 Performing capping
4.5 Ensuring weld deposit
4.6 Cleaning Joints
4.7 Weld defects

LO5. Ensure weld conformance
5.1 Removing defects.
5.2 Inspecting weld joints visually.
5.3 Completing and maintaining weld records.

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 materials for Gas Metal Arc Welding (GMAW)

- Weld requirements are identified from specifications and/or drawings.
- Materials are correctly prepared in accordance with job specifications.
- Materials are assembled /aligned to specification, where required.

LO.2 Select and assemble welding machine / equipment

- Necessary tools and equipment are selected and made ready for operational activity
- Welding machine settings, accessories and consumables are identified.
- Welding machine is positioned in proximity to work, does not pose as obstruction and is protected from damage due to dust, falling objects or rainfall.
- Welding machine settings, accessories and consumables are selected.
- Welding equipment is assembled and set-up to specifications.
- Current, voltage, and wire feed settings are fine-tuned or adjusted consistent with job requirements to produce acceptable weld.
- Welding machine is wired up or set to the polarity indicated in the welding procedures/specifications or as recommended by the filler wire manufacturer
- Welding machine is connected to an independent power supply.

LO.3 Minimize and rectify distortion

- Appropriate distortion prevention measures are selected for weld and material type.
- Distortion is rectified according to work procedures Dimensions and material requirements are identified, understood and followed as required.
- OHS procedures are observed throughout the process

LO.4 Weld to job specification using GMAW

- Root pass is performed in accordance with specifications and enterprise/industry requirements 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 procedure
- Weld deposit is ensured to be within specifications
- Joints are cleaned and free from discontinuities
- Welded parts are free from weld defects or porosity.

LO5. Ensure weld conformance

- Defects are removed with minimum loss of sound metal using techniques and tools appropriate to the defect, material and process.
- Weld joints are visually inspected for conformance to specifications.
- Weld records are completed and maintained correctly as required

Annex: Resource Requirements

IND MCS3 M03 0322 Performing Gas Metal Arc Welding (GMAW)				
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	- Winkelmann, Manufacturing Engineering (Teaching Material) Technical University of Dresden, 198	5	1:5
B.	**Learning Facilities & Infrastructure**			
1.	Lecture Room	6mx6m	1	1:25
2.	Library	STD	1	1:25
3.	Work shop	STD	1	1:25
C.	**Consumable Materials**			
1.	A4 paper	Packet	5	1:5
2	mild steel flat iron	10mmx100mmx6000mm	1	1:25
3	mild steel round pipe	10mmx100Øx6000 mm	1	1:25
4	Mild steel flat iron	3mmx100mmx6000mm	1	1:25
5	MAG wire	Ø1mm, 0.8mm 25kg	1	1:25
6	Shielding gas (available inert gas)	CO2, argon, helium	3	1:5
7	Glove	Pair	25	1:1
8	Welding Google	Pcs	25	1:1
9	Safety shoes	Pcs	25	1:1
10	Leather apron	Pcs	25	1:1
11	Grinding disc	Pcs	5	1:5
12	Cutting disc	120 and 80	5	1:5
D	**Tools and Equipments**			
1.	MIG/MAG Welding Machine	STD	5	1:5
2	Power hack saw	STD	1	1:25
3	Steel rule	30-50mm	25	1:5
4	Hack saw	Standard	5	1:5
5	Vernier caliper	0.02mm,0.05mm	5	1:5
6	Portable grinder	Standard/ makita	5	1:5

LEARNING MODULE 04
TVET-PROGRAMME TITLE: Mechanics **Level III**
MODULE TITLE: **Performing Gas Tungsten Arc Welding (GTAW)**
MODULE CODE: **IND MCS3 M04 0322**
NOMINAL DURATION: **80 Hours**
MODULE DESCRIPTION: This module covers the knowledge, attitudes and skills required in preparing materials, selecting and setting up the welding equipment, carrying out the Gas Tungsten Arc Welding (GTAW) and inspecting and correcting defects in fabrication and assembly of metals.
LEARNING OUTCOMES At the end of the module the trainee will be able to: **LO1.** Prepare materials for Gas Tungsten Arc Welding (GTAW) **LO2.** Select and assemble welding machine / equipment **LO3**. Minimize and rectify distortion **LO4.** Weld to job specification using GTAW **LO5.** Ensure weld conformance
MODULE CONTENTS: **LO1.** Prepare materials for Gas Tungsten Arc Welding (GTAW) 1.1 Identifying Weld requirements 1.2 Preparing materials 1.3 Assembling/aligning materials. **LO2.** Select and assemble welding machine / equipment 2.1 Identifying and selecting welding tools, equipment and electrodes 2.2 Positioning welding machine in proximity to work 2.3 Selecting welding machine settings, accessories and consumable 2.4 Assembling and setting-up welding equipment 2.5 Fine-tuning or adjusting current and voltage setting. 2.6 Setting welding machine to polarity. 2.7 Welding codes 2.8 Identifying types of electrodes, gases and their uses 2.9 Connecting welding machine an independent power supply 2.10 Weld carbon steel pipes using TIG in 2G and 5G and/or 6G positions
LO3. Minimize and rectify distortion 3.1 Selecting distortion prevention measures 3.2 Rectifying distortion 3.3 Observing OHS procedures **LO4** Weld to job specification using GTAW 4.1 Performing root pass 4.2 Cleaning root pass 4.3 Performing subsequent filling passes 4.4 Performing capping 4.5 Ensuring weld deposit 4.6 Cleaning Joints 4.7 Weld defects or porosity **LO5.** Ensure weld conformance 5.1 Removing defects 5.2 Inspecting weld joints visually. 5.3 Completing maintaining weld records.

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 materials for Gas Tungsten Arc Welding (GTAW)

- Weld requirements are identified from specifications and/or drawings.
- Materials are correctly prepared in accordance with job specifications.
- Materials are assembled/ aligned to specification, where required.

LO.2 Select and assemble welding machine / equipment

- Welding tools and equipment, electrodes, accessories and consumables appropriate to the material are identified and selected
- Welding machine is positioned in proximity to work, does not pose as obstruction and is protected from damage due to dust, falling objects or rainfall.
- Welding machine settings, accessories and consumables are selected.
- Welding equipment are assembled and set-up to specifications.
- A current and voltage settings are fine-tuned or adjusted consistent with job requirements to produce acceptable weld.
- Welding machine is set to the polarity indicated in the welding procedures/specifications or as recommended by the filler wire manufacturer
- Welding machine is connected to an independent power supply.

LO.3 Minimize and rectify distortion

- Appropriate distortion prevention measures are selected for weld and material type.
- Distortion is rectified according to work procedures.
- OHS procedures are observed throughout the process.

LO.4 Weld to job specification using GTAW

- Root pass is performed in accordance with specifications and enterprise/industry requirements 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
- Weld deposit is ensured to be within specifications.
- Joints are cleaned and free from discontinuities.
- Welded parts are free from weld defects or porosity.

LO5. Ensure weld conformance

- Defects are removed with minimum loss of sound metal using Techniques and tools appropriate to the defect, material and process.
- Weld joints are visually inspected for conformance to specifications.
- Weld records are completed and maintained correctly as required.

Annex: Resource Requirements

IND MCS3 M04 0322 Performing Gas Tungsten Arc Welding (GTAW)				
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
4.	Journals/Publication/Magazines			
B.	**Learning Facilities & Infrastructure**			
1.	Lecture Room	Standard	1	1:25
2.	Library	Standard	1	1:25
3.	Work shop	Standard	1	1:25
C.	**Consumable Materials**			
1.	A4 paper	Packet	5	1:5
2	Copper filler rod	Standard	1	1:25
3	Mild steel plate	4mmx50mm6000mm	1	1:25
4	Tungsten rod/electrode	Dia.2mm-6mm	10	1:5
5	Shielding gas	Argon	Cylinder	1:25
6	Glove	Pair	25	1:1
7	Welding Google	Standard	25	1:1
8	Safety shoes	STD	25	1:1
9	Leather Apron	STD	25	1:1
10	Grinding disc	180 mmØ	5	1:5
11	Cutting disk	180mm Ø	5	1:5
D.	**Tools and Equipments**			
1.	TIG Welding Machine with accessories	STD	5	1:5
2	Power hack saw	Pcs	1	1:25
3	Steel rule	30-50mm	25	1:1
4	Hack saw	Pcs	5	1:5
5	Vernier caliper	0.05, 0.02mm	5	1:5
6	Portable grinder	STD makita	5	1:5

LEARNING MODULE 05
TVET-PROGRAMME TITLE: **MECHANICS Level III**
MODULE TITLE: **Performing Manual and Precision Assembly**
MODULE CODE: **IND MCS3 M05 0322**
NOMINAL DURATION: **50 Hours**
MODULE DESCRIPTION: This unit covers skill, knowledge and attitudes required in assembling and testing complex engineering components and mechanical assemblies in a production line.
LEARNING OUTCOMES At the end of the module the trainee will be able to: **LO1. Prepare for work** **LO2. Assemble engineering components** **LO3. Assure quality assembled items**
MODULE CONTENTS: **LO1. Prepare for work** 1.1 Determining OHS procedures 1.2 Selecting and checking all components/sub-assemblies 1.3 Carrying fitting requirements and sequential assembly planning. 1.4 Following OHS procedures **LO2. Assemble engineering components** 2.1. Preparing components/sub components for assembly. 2.2. Applying techniques and principles. 2.3. Fitting components of assembly. 2.4. Performing final adjustments on assembly. 2.5. Identifying faulty assembly **LO3. Assure quality assembled items** 3.1 Testing assembly 3.2 Identifying assembly 3.3 Handling and storing components and/or assembly 3.4 Recording and reporting assembly results

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	❖ Speak loudly ❖ Using sign language interpreter if	❖ Use written response as an option for the

		the proper communication was conducted with the trainee through the service of the sign language interpreter ❖ Use short and clear questioning ❖ Time extension	necessary	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 for work

- Work requirements are determined / interpreted correctly from work sheet or other instructions in accordance with standard operating procedures.
- All components/sub-assemblies are checked against work sheet, assembly list or equivalent instructions
- Fitting requirements and sequential assembly planning are carried according to operational procedures
- Tools, equipment and components/sub-assemblies are selected to meet work requirements
- OHS procedures are followed through the process in this unit.

LO2. Assemble engineering components

- Components/sub components are correctly prepared for assembly according to standard operating procedure
- Techniques and principles appropriate to the job requirements are applied according to operational standards
- Components of assembly are fitted to ensure correct positioning and conformance with specifications.
- Final adjustments are performed on assembly to ensure alignment with operational specifications.
- Faulty assemblies are identified for rework or when the fault is outside the scope of the workstation, processed according to standard operating procedure.

LO3. Assure quality assembled items

- Assembly is tested to ensure that components interface/ interact according to operational specifications
- The assembly is correctly marked/tagged/identified due to specification
- Components and/or assembly are handled and stored according to standard operating procedures and in a manner least likely to cause damage
- Assembly results are recorded and reported in accordance with operational specifications

Annex: Resource Requirements

IND MCS3 05 0322 Performing Manual and Precision Assembly				
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	Manufacturing Assembly Handbook Book . 1986 By: Bruno Lotter	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	Paper	A4	1desta	1:25
2	Whit board marker	Max-fill	1packet	1:25
3	Bolts and nuts	M10X1.5mm	1packet	1:25
4	Screws	Std	1packet	1:25
5	Rivets &studs	Std	1packet	1:25
6	Electrode	Ø2.5mm, Ø3.2mm	5packet	1:5
7	Grinder disk	Ø180mm	5	1:5
8	Cutter disk	Ø180mm	5	1:5
9	Drill bit	Ø3mm- Ø12mm	1set	1:25
10	Whit board	STD	1	1:25
D.	**Tools and Equipments**			
1	Meter	3M and 5M	5	1:5
2	caliper	0.02mm, 0.05	5	1:5
3	Arc Welding machine	AC /DC	5	1:5
4	Ball pen hammer	5kg	5	1:5
5	Rivet gun	Spring type	5	1:5
6	Portable electric grinder	STD Makita	5	1:5
7	Portable electric Drill	STD	5	1:5

LEARNING MODULE 06

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

MODULE TITLE: **Performing Machine, equipment Plant Installation and commission**

MODULE CODE: **IND MCS3 M06 0322**

NOMINAL DURATION: **50 Hours**

MODULE DESCRIPTION: This unit covers the knowledge, skills and attitudes required installing machines and plants. It includes performing complex machine connection and setting, commissioning work and new installation or existing sites.

LEARNING OUTCOMES

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

LO1. Prepare installation site

LO2. Install machine/ plant

LO3. Assure quality installation work

MODULE CONTENTS:

LO1. Prepare installation site

1.1 Interpreting work design.
1.2 Inspecting and analyzing waste disposal.
1.3 Preparing commissioning procedure.
1.4 Developing operational chart.
1.5 Reporting non-compliance with specification.
1.6 Obtaining future capacity requirement.
1.7 Establishing productivity improvement areas.
1.8 Undertaking alteration/correction.
1.9 Processing data using applicable software.

LO2. Install machine/ plant

2.1 Preparing sequential installation
2.2 Installing machine/plant.
2.2.1 Manufacturers manuals, operating manual, specification, symbols, manual.
2.2.2 Workplace layout principles
2.3 Undertaking routine modifications/alterations
2.4 Moving, positioning, leveling, aligning, coupling and connecting machine/plant
2.4.1.Engineering processes and systems
2.4.2.Materials flow patterns
2.4.3.Types of production plant and machinery
2.4.4.Materials handling methods
2.5 Carrying out works.
2.6 Instructing machine set operator on OHS procedures

LO3. **Assure quality installation work**

3.1. Carrying-out test of process
3.2. Measuring and inspecting first-off samples
3.2.1 Definition and measures of productivity
3.2.2. Factors affecting productivity
3.2.3. Productivity, quality and value adding
3.3. Performing trouble shooting and fault finding
3.4. Clearing clutters from the installation and left in safe state.
3.5. Preparing and completing reports and documentation.
3.5.1. Recording techniques
3.4.1. Flow charts and flow process charts

3.4.2. Activity relationship charts 3.4.3. Outline process charts 3.4.4. Multipurpose charts and string diagrams 3.4.5. Basic principle of ergonomics

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)	❖ 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

	❖ Time extension			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 installation site

- Design work is correctly interpreted according to specifications and manufacturers' manual
- Location, foundation, power requirements, ventilation, work flow and **waste** disposal are inspected and analyzed due to operational regulations
- Non-compliance with specification is reported to appropriate authority using a formal site report
- Future capacity requirement is obtained in accordance with policy and procedures
- Productivity improvement areas are established in accordance with organizational policy and procedures
- Alteration/correction is undertaken with the approval of appropriate authority
- Site report on preparation stage is logged with contractor

LO2. Install machine/ plant

- Machine components are prepared for correct sequential installation procedures
- Machine/plant is installed in accordance with manufacturers manual and site specifications according to contract
- Routine modifications/alterations to equipment and supporting structures are undertaken based on standard operating procedures
- Machine/plant is moved, positioned, leveled, aligned, coupled connected and any other parameter (excluding electrical connections) in accordance with specifications
- All works are carried out safely and in accordance with workplace procedures and to the given standards
- Machine set operator is instructed, if necessary, on sequence settings and any required OHS procedures

LO3. Assure quality installation work

- Test of process is carried-out in accordance with manufactures specifications
- First-off samples are measured and inspected for compliance with specifications
- Trouble shooting and fault finding are performed based on manufacturers' manual
- All clutters from the installation are cleared and workplace is left in safe state according to environmental legislation
- All reports and documentation are prepared and completed correctly based on standard procedures and format.

Annex: Resource Requirements

IND MCS3 M06 0322 **Performing Machine, equipment Plant Installation and commission**				
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. Kececioglu, Dimitri, Maintainability, Availability, and Operational Readiness Vol. I, Prentice - Hall PJR, Upper Saddle River, NJ, 1995.	5	1:5
3.1	Textbook			
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	A4	Rim	1:5
2.	White board marker	Max-fill	Pac	1:1
3	Coolants/Lubricants			
4	Oil	No.10&40	Litters	1:25
5	Grease	Kg		1:25
6	Detergents		Us req.	1:25
7	Oil rag		Kg	1:25
D.	**Tools and equipment's**			
1.	Dial indicator	Magnetic type	5	1:5
2.	Micrometer	0.01mm	5	1:5
3	Precision spirit level	STD	5	1:5
4	Vernier caliper	0.05mm	5	1:5
5	Micrometer	0-25mm &25-50mm	5	1:5
7	String		As required	
8	• Mounting pad/plate • Anchor bolts	STD	As required	

LEARNING MODULE 07
TVET-PROGRAMME TITLE: **Mechanics Level III**
MODULE TITLE: **Maintaining and Repairing Industrial Electrical Machines drive and Components**
MODULE CODE: **IND MCS3 M07 0322**
NOMINAL DURATION: **60 Hours**
MODULE DESCRIPTION: This module covers the skill, knowledge and attitudes required to perform maintenance, fault finding and repair of mechanical engineering components and assemblies. It includes spare parts manufacturing, fitting, final adjustment and commissioning.
LEARNING OUTCOMES At the end of the module the trainee will be able to: **LO1.** Determine plan, prepare coordinate maintenance and repair work **LO2.** Maintain and repair electrical drive system and components **LO3**. Manufacture spare parts/ components **LO4.** Assure quality maintained or repaired components
MODULE CONTENTS: **LO1. Determine plan, prepare coordinate maintenance and repair work** 1.1 Following safety policies and procedures strictly 1.2 Preparing maintenance work 1.3 Interpreting and understanding test, maintenance and repair specifications. 1.3.1 Components 1.3.2 assemblies 1.3.3 machinery 1.4 Obtaining and setting up correct measuring/test devices. 1.5 Taking measurements/readings at appropriate points. 1.6 Recording all variances from specifications. 1.7 Detecting causes of faults using appropriate tools and equipment. 1.8 Determining data list of maintenance, repair, replacement, adjustment or requirements. 1.9 Informing responsible department/personnel on the schedule of work. **LO2. Maintain and repair electrical drive system and components** 2.1. Preparing availability of maintenance records. 2.2. Diagnosing readings of electrical test instruments. 2.3. Referring identified defective instruments for calibration/replacement. 2.4. Inspecting mechanical fasteners and tightening regularly. 2.5. Servicing plant/machine/ assemblies.
2.6. Inspecting and replacing belts and drives. 2.7. Servicing and/or replacing runners, rollers and transport systems of plant. 2.8. Testing safety features of plant/machine 2.9. Testing electrical/Electronic systems. 2.10. Testing Hydraulic and Pneumatic systems. 2.11. Selecting when applicable, replacement parts. 2.12. Determining where applicable, appropriate method of repair. 2.13. Repairing or adjusting where applicable, faulty components to conform with specifications 2.14. Applying appropriate lubricants **LO3**. **Manufacture spare parts/ components**

3.1. Determining replacement components/spare parts
3.2. Producing replacement components/spare parts using **workshop practice**
3.3. Testing completed components/Spare parts.

LO4. Assure quality maintained or repaired components

4.1. Testing component/unit under operational conditions.
4.2. Approving out of specification modification/alterations by appropriate authority.
4.3. Recording and documenting out of specification modification/alterations
4.4. Commissioning and returning final component assembly to service.
4.5. Recording and re –ordering spare.
4.6. Producing report/logs on completed system/plant/ machinery/status/performance.

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. Determine plan, prepare coordinate maintenance and repair work

- Safety policies and procedures are strictly followed
- **Maintenance work** is prepared in accordance with machine or drive operating time schedule or condition
- Test, maintenance and repair specifications for components, assemblies and machinery are interpreted and understood in accordance with **manufacturers' manual**
- Correct measuring/test devices are obtained and set up in compliance with specification
- Measurements/readings are taken at appropriate points based on manufactures' instruction
- All variances from specifications are recorded based on standard operating procedures
- Causes of faults are detected using appropriate engineering principles, techniques, procedures, tools and equipment.
- Data list of maintenance, repair, replacement, adjustment or requirements are determined due to regulations
- Responsible department/personnel are informed on the schedule of work according to standard operating procedure

LO2. Maintain and repair electrical drive system and components

- Availability of **maintenance records** are prepared in accordance with established procedure, or based on enterprise Quality Management System (QMS).
- Readings of **electrical test instruments** are diagnosed and identified defective instruments are referred for calibration/replacement in accordance with enterprise procedure
- Mechanical fasteners are inspected and regularly tightened according to tensile strength, sizes and torque requirements
- **Plant**/machine/ assemblies is/are serviced according to Maintenance Plan and Schedule (MPS)
- Belts and drives are inspected and replaced according to MPS
- Runners, rollers and transport systems of plant are serviced and/or replaced according to MPS
- Safety features of plant/machine are tested to ensure its workability according to planned maintenance schedule
- Electrical/Electronic systems are tested according to specification
- Hydraulic and Pneumatic systems are tested according to specifications.
- When applicable, replacement parts are selected from manufacturers' catalogues and assessed against specification
- Where applicable, appropriate method of repair is determined based on standard procedures
- Where applicable, faulty components are repaired or adjusted to conform with specifications

LO3. Manufacture spare parts/ components

- Replacement components/spare parts specifications are determined from appropriate source according to manufacturers' standard
- Replacement components/spare parts are produced using appropriate **workshop practice** compliant with genuine specifications
- Completed components/Spare parts are tested in accordance with genuine

specifications

LO4. Assure quality maintained or repaired components

- Component/unit is tested under operational conditions using acceptable engineering principles for compliance to operational specifications
- Out of specification modification/alterations are approved by appropriate authority and are recorded and documented to standard operating procedure
- Final component assembly is commissioned and returned to service according to standard operating procedures
- Spare parts are recorded and re –ordered as needed due to genuine specifications
- Report/logs are produced on completed system/plant/ machinery/status/performance as required in accordance with company operating procedures

Annex: Resource Requirements

IND MCS3 M07 0322 Maintaining and Repairing Industrial Electrical Machines drive and Components				
Item No.	**Category/Item**	**Description/ Specifications**	**Quantity**	**Recommended Ratio (Item: Trainee)**
A.	**Learning Materials**			
1.	TTLM	TTTLM prepared by the trainer	25	1:5
2.	Reference Books	Vedam Subramanian: Electric Drives Concepts and applications by, McGraw-Hill 1996 -Electric Drive by Jacob Feinberg, Mir Publishers, 1978		
3.1	Textbooks			
4.	Journals/Publication/Magazines			
B.	**Learning Facilities & Infrastructure**			
1.	Lecture Room	6*8m	1	1:25
2.	Workshop	10x15m	1	1:25
3.	Library	20x20	1	1:25
C.	**Consumable Materials**			
1.	Mechanical components			
2				
D.	**Tools and Equipments**			
1.	Multi-meter (VOM/DMM)		5pcs	1:5
2	Insulation resistance tester (Megger)		5pcs	1:5
3	High potential tester		5pcs	1:5
4	Low resistance tester		5pcs	1:5
5	Phase sequence meter		5pcs	1:5
6	Ammeter		5pcs	1:5
7	Wrench	Set	5pcs	1:5
8	Screw driver (Flat and Philips)	Set	5pcs	1:5
9	Three phase induction motor	STD	1	1:5
10	DC motors (series, shunt, compound, …)	STD	5	1:5
11	Magnetic contactor	STD	1	1:5
12	Overload relay	STD	1	1:5
13	Timer contact	STD	1	1:5
14	Three phase circuit breaker, single phase circuit breaker,	STD	2	1:5
15	Electrical wires	(1mm, 1.5mm, 2.5mm)	As required	1:5
16	Pushbuttons	STD		1:5
17	Limit switch	STD	1	1:5
18	Indicator lamp	STD	5	1:5

LEARNING MODULE 08
TVET-PROGRAMME TITLE: **Mechanics Level III**
MODULE TITLE: **Installing and Maintaining Basic Pneumatic and Hydraulic Systems**
MODULE CODE: **IND MCS3 M08 0322**
NOMINAL DURATION: 60 **Hours**
MODULE DESCRIPTION: This module covers the knowledge, skills and attitudes necessary to install, test and maintain basic pneumatic and hydraulic systems.
LEARNING OUTCOMES At the end of the module the trainee will be able to: **LO1.** Plan and Prepare work **LO2.** Install basic pneumatic and hydraulic circuits **LO3.** Test and repair components and circuits **LO4.** Assure quality and maintain work
MODULE CONTENTS: **LO1. Plan and Prepare work** 1.1. Reading and interpreting basic pneumatic circuit diagrams and symbols. 1.2. Reading and interpreting basic hydraulic circuit diagrams and symbols. 1.3. Identifying and selecting pneumatic and hydraulic components. 1.4. Planning and sequencing installation work. 1.5. Selecting and obtaining correct tools and auxiliary equipment. **LO2. Install basic pneumatic and hydraulic circuits** 2.1. Joining and terminating pneumatic and hydraulic lines/piping. 2.2. Wearing appropriate personal protective equipment 2.3. Following OHS policies and procedures for installation. 2.4. Following instrumentation and control standards. 2.5. Installing basic pneumatic and hydraulic circuits. 2.6. Inspecting components and fittings on functionality and correcting possible faults. 2.7. Applying maintenance requirements on system. 2.8. Applying work safety practices for pneumatics and hydraulics. **LO3. Test and repair components and circuits** 3.1. Establishing test equipment and test procedures. 3.2. Testing all components and lines. 3.3. Testing basic pneumatic and hydraulic circuits. 3.4. Identifying and reporting timely faults. 3.5. Performing repair on components and circuit. 3.6. Recording test results. **LO4. Assure quality and maintain work** 4.1. Maintaining installation of pneumatic system.
4.2. Maintaining installation of hydraulic system. 4.3. Maintaining pneumatic and hydraulic safety. 4.4. Documenting test equipment and procedures. 4.5. Cleaning work site

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. Plan and Prepare work

- Basic pneumatic circuit diagrams and related component symbols are read and interpreted according to standards
- Basic hydraulic circuit diagrams and related component symbols are read and interpreted according to standards
- Pneumatic and hydraulic **components** are identified and selected according to diagram and standard
- Installation work is appropriately planned and sequenced in accordance with requirements
- Correct tools and auxiliary equipment are selected and obtained according to specifications and task

LO2. Install basic pneumatic and hydraulic circuits

- Pneumatic and hydraulic lines/piping are joined and terminated according to diagrams and standards
- Appropriate personal protective equipment are worn in line with standard operating procedures.
- **OHS policies and procedures** for installation are followed in line with the requirements.
- Instrumentation and control standards are followed in line with the job requirements.
- Basic pneumatic and hydraulic circuits are installed in accordance with specifications and operational procedures
- Components and fittings are inspected on functionality and possible faults corrected according to specifications
- Maintenance requirements on system are applied based on manufactures' specifications
- Work safety practices for pneumatics and hydraulics are applied according to specification and standard

LO3. Test and repair components and circuits

- Test equipment and test procedures are established based on work task and specifications
- All components and lines are tested on functionality and leakages due to operational and test pressure requirements
- Basic pneumatic and hydraulic circuits are tested on functionality in accordance with operational procedures
- Faults are identified and reported timely to appropriate personnel in accordance with operational procedures
- Repair on components and circuit is performed following safety standards and manufactures' specifications
- Test results are recorded in compliance with operational requirements

LO4. Assure quality and maintain work

- Installation of pneumatic system is maintained to specification
- Installation of hydraulic system is maintained to specification
- Pneumatic and hydraulic safety is maintained to standard
- Test equipment and procedures are documented according to regulations
- Work site is cleaned and all debris are cleared of and left safe in accordance with the company requirements

Annex: Resource Requirements

IND MCS3 M08 0322 Installing and Maintaining Basic Pneumatic and Hydraulic Systems				
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	Theo and Farias, Engineering application of hydraulic and pneumatic, 2018.	5	1:5
3.	Reference Books	-Introduction to fluid power system by James .L Johnson Fluid power with application seventh edition -Fluid Power Edited by Mary Gannon and Richard Schneider, Hydraulics & Pneumatics magazine.	5	1:5
4.	Journals/Publication/Magazines			
B.	**Learning Facilities & Infrastructure**			
1.	Lecture Room	6*8m	1	1:25
2.	Laboratory	15x5m	1	1:25
3.	Library	20x20	1	1:25
C.	**Consumable Materials**			
1.	Fluid (air, oil)	STD barrel	10	1:1
D.	**Tools and Equipments**			
1.	Pressure meter		5	1:5
2	Leakage detectors		5	1:5
3	Multi meters		5	1:5
4	Process switches		5	1:5
5	Wrench	Set	5	1:5
6	Screw driver (flat & Philips)	set	5	1:5
7	Hydraulic and pneumatic valves, connecting houses and actuators etc.	STD	As required	1:5
8	Compressor, pump, hydraulic motor,	STD	5	1:5

LEARNING MODULE 09
TVET-PROGRAMME TITLE: **MECHANICS LEVEL III**
MODULE TITLE: **Installing Electrical Measuring Instruments and Control Device**
MODULE CODE: **IND MCS3 M09 0322**
NOMINAL DURATION: 50 **Hours**
MODULE DESCRIPTION: This module covers the knowledge, skills and attitudes necessary to install instrumentation, industrial wiring and control devices.
LEARNING OUTCOMES At the end of the module the trainee will be able to: **LO1.** Plan and Prepare Installation work **LO2.** Install instrumentation and control devices **LO3**: Assure quality instrumentation and control devices **LO4**: Clean-up
MODULE CONTENTS: **LO1. Plan and Prepare Installation work** **1.1** Reading Work order and drawing to correct **1.2** Planning Installation and connection of electrical measuring instruments with control devices **1.3** Obtaining Materials necessary to complete the work **LO2. Install instrumentation and control devices wear** 2.1. Applying OHS policies and procedures inclusive protective clothing for installation 2.2. Wearing Appropriate Personal Protective Equipment (PPE) 2.3. Following OHS policies and procedures for installation 2.4. Following Instrumentation and control standards 2.5. Wiring and connecting Devices or tools **LO3 Assure quality instrumentation and control devices** 3.1. Testing Devices functionally 3.2. Doing Relevant commissioning tests 3.3. Documenting Process of equipment installation and testing **LO4**: **Clean-up** 4.1 Cleaning Devices and Work site

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. Plan and Prepare Installation work

- Work order and drawing are read and correct interpreted in compliance with work requirements
- Installation and connection of electrical metering units or measuring instruments with their relative control devices is planned according to task instructions
- Materials necessary to complete the work are obtained in accordance with work requirements.

LO2. Install instrumentation and control devices wear

- OHS policies and procedures inclusive protective clothing for installation are applied in line with the regulations
- Appropriate Personal Protective Equipment (PPE) are worn in line with standard operating procedures.
- OHS policies and procedures for installation are followed in line with the requirements.
- Instrumentation and control standards are followed in line with the job requirements.
- Devices or tools are wired and connected in accordance with manufacturer's instructions, requirements, and without damage to the surrounding place or environment
- Events or conditions are responded to in accordance with established procedure

LO3 Assure quality instrumentation and control devices

- Devices are tested functionally in accordance with standard procedures
- Relevant commissioning tests are done to ensure compliance of statutory requirements
- Process of equipment installation and testing is documented according to company's procedures/policies

LO4: **Clean-up**

- Work site is cleaned and cleared of all debris and left safe in accordance with the company requirements
- Devices are cleaned in accordance with standard procedures

Annex; Resource Requirements

IND MCS3 M09 0322 Installing Electrical Measuring Instruments and Control Devices				
Item No.	Category/Item	Description/ Specifications	Quantity	Recommended Ratio (Item: Learner)
A.	**Learning Materials**			
1.	TTLM	To be prepared by a trainer	25	1:25
2.	Textbooks	-	-	-
3.	Reference Books	-Basic Electrical Engineering, by A.E. Fitzgerald & D.E. -Elements of Electrical Engineering, by Cook and Carn	5	1:5
B.	**Learning Facilities & Infrastructure**			
1.	Lecture Room	5m*7m	1	1:25
2.	Library	8mX20m	1	1:25
3.	Work shop	8mx20m	1	1:25
C.	**Consumable Materials**			
1.	Active components(diode, transistors …)	STD	5	1:5
2.	Connective wires and cables	STD		
3.	Passive components (Resistors, inductor)	STD	5	1:5
4	Sealing material and fastener	STD	As required	1:5
D.	**Tools and Equipments**			
1.	Hand tools (pliers, screw drivers, insulation remover…)	STD	As required	1:5
2.	Bread board	STD	5	1:5
3.	DC power supply (0-24V)	STD	5	1:5
4.	Measuring instruments (Voltmeter, ammeter, ohmmeter, multimeter…)	STD	5	1:5
5.	Insulation tester or (Megger)	STD	5	1:5
6.	Screw drivers	Flat and Philips	5	1:5
7.	Soldering iron/gun	STD	5	1:5

LEARNING MODULE 10
TVET-PROGRAMME TITLE: **MECHANICS LEVEL III**
MODULE TITLE: **Applying protective coatings**
MODULE CODE: **IND MCS3 M10 0322**
NOMINAL DURATION: **40 Hours**
MODULE DESCRIPTION: This module covers skill, knowledge and attitudes required to spraying pre-treatments and protective coatings not limited to brush, roller and conventional spray equipment, at a basic level.

LEARNING OUTCOMES

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

LO1. Determine job requirements
LO2. Prepare work piece for protective coating
LO3: Prepare equipment for surface coating materials
LO4: Apply single pack coatings
LO5: Clean and store equipment
LO6: Inspect finish surface
LO7: Select and maintain personal protective equipment (PPE)

MODULE CONTENTS:

LO1. Determine job requirements
- 1.1 Determining work requirements from drawings.
- 1.2 Identifying required protective coating materials
- 1.3 Identifying protective coating application equipment.
- 1.4 Preparing work site

LO2. Prepare work piece for protective coating
- 2.1 Inspecting surface condition
- 2.2 Identifying un suitable work pieces/surfaces and fabrication defects
- 2.3 Masking components.
- 2.4 Identifying conditions for overspray

LO3: Prepare equipment for surface coating materials
- 3.1 Understanding required plant and equipment basic operations.
- 3.2 Undertaking routine maintenance
- 3.3 Recording states/reports by Performa or orally
- 3.4 Assembling Conventional coating application equipment.

LO4: Apply single pack coatings
- 4.1 Identifying appropriate coating product type,
- 4.2 Demonstrating correct method of wet film thickness
- 4.3 Thinning coating material to suit the application method.
- 4.4 Applying coating methods.
- 4.5 Outlining coating schedules for metal and non-metal materials.
- 4.6 Monitoring coating application and curing technique

LO5: Clean and store equipment
- 5.1 Cleaning, disassembling and inspecting conventional coating application equipment
- 5.2 Recording Faulty equipment
- 5.3 Storing coating application equipment

LO6: Inspect finish surface

6.1 Assessing surface finish
6.2 Determining coating thickness
6.3 Inspecting total surface results for conformance

LO7: Select and maintain personal protective equipment (PPE)

7.1 Selecting and using appropriate personal protective equipment
7.2 Identifying ancillary support attachments
7.3 Maintaining Personal protective 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 ❖ Provide tutorial support (if necessary)	❖ Illustrate in clear & short method ❖ Use Video recorded material ❖ Ensure the attention of the trainees ❖ Provide 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 ❖ Provide 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. Determine job requirements

- Work requirements are determined from job sheet, instructions, drawings or visual inspection.
- Required protective coating materials are identified according to job specification.
- Required protective coating application equipment is identified according to job requirements.
- Work site is prepared for application of protective coating

LO2. Prepare work piece for protective coating

- Surface condition is inspected for readiness for application of protective coating according to specification.
- Unsuitable work pieces/surfaces and fabrication defects are identified and appropriate remedial action or reporting is undertaken in accordance with standard operating procedures.
- Components are masked where protective coating application is not specified.
- Conditions for overspray are identified.

LO3: Prepare equipment for surface coating materials

- Required plant and equipment basic operations are understood.
- Routine maintenance is undertaken on plant and equipment in accordance with standard operating procedures.
- Status/reports are recorded by Performa or orally in accordance with standard operating procedures.
- Conventional coating application equipment is assembled in accordance with equipment requirements and standard operating procedures.

LO4: Apply single pack coatings

- Coating product type, solvent, uses, mixing procedure, clean-up and safety requirements are identified as appropriate.
- Correct method of determining wet film thickness in accordance with specified dry film is demonstrated.
- Coating material is thinned to suit the application method and to achieve required film thickness.
- Coating is applied using specified application method and standard operating procedures.
- Coating schedules can be outlined for metal and non-metal materials.
- Coating application and curing technique are monitored according to standard operating procedures.

LO5: Clean and store equipment

- Conventional coating application equipment is cleaned, disassembled and inspected for damage
- Faulty equipment is recorded and reported to appropriate personnel in accordance with standard operating procedures.
- Coating application equipment is stored in accordance with standard operating procedures

LO6: Inspect finish surface

- Surface finish is assessed for profile size differences and uses.
- Coating thickness is determined using appropriate instruments and results are compared with job specifications.
- Total surface is inspected for conformance to specification in accordance with

standard operating procedures.

- Inspection results are recorded and reported in accordance with standard operating procedures

LO7: Select and maintain personal protective equipment (PPE)

- Appropriate personal protective equipment for coating application is selected according to job requirements and standard operating procedures.
- .Personal protective equipment is used appropriately in accordance with manufacturers' specifications and standard operating procedures.
- Ancillary support attachments are identified and used.
- Personal protective equipment is maintained in accordance with manufacturers' specification and standard operating procedures.

Annex; Resource Requirements

IND MCS3 M10 0322 Applying Protective Coating				
Item No.	Category/Item	Description/ Specifications	Quantity	Recommended Ratio (Item: Learner)
A.	**Learning Materials**			
1.	TTLM	To be prepared by a trainer	25	1:25
2.	Textbooks	-	-	-
3.	Reference Books	SSPC Pocket guide to coating information by SSPC: The Society for Protective Coatings | Oct 30, 2009	5	1:5
4.	Journals/Publication/Magazines	-	-	-
B.	**Learning Facilities & Infrastructure**			
1.	Lecture Room	5m*7m	1	1:25
2.	Library	8mX20m	1	1:25
3.	Work shop	8mx20m	1	1:25
C.	**Consumable Materials**			
1.	Antirust	STD		
2.	Solvent	Uses for mixing procedures		
3	Brush	STD	10	1:5
D.	**Tools and Equipments**			
1.	Multi-meter (VOM/DMM)	STD	5	1:5
2.	High potential tester	STD	5	1:5
3.	Low resistance tester	STD	5	1:5
4.	Electrical hand tools	STD	5	1:5
5.	Testing instruments/devices	STD	5	1:5
6.	Testing equipment	STD	5	1:5
7.	Personal protective equipment	STD	5	1:5
8.	Spray gun	STD	1	1:25
9	Compressor	STD	1	1:25

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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