MECHANICS
LEVEL – IV



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 mechanics Level IV**.**

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 IV

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 plan and organize work, install and commission equipment and machineries, estimate manufacturing and maintenance cost, supervise and guide Computer-Integrated Manufacturing (CIM) production Operations, check advanced nneumatic and hydraulic system, perform automated thermal cutting, perform brazing and silver soldering, prepare and produce specialized coatings procedures 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 MCS4 01 1221 Plan and organize work
IND MCS4 02 1221 Install and commission equipment and machineries
IND MCS4 03 1221 Estimate manufacturing and maintenance cost
IND MCS4 04 1221 Supervise and guide Computer-Integrated Manufacturing (CIM) production Operations
IND MCS4 05 1221 Check aadvanced pneumatic and hydraulic system
IND MCS4 06 1221 Perform automated thermal cutting
IND MCS4 07 1221 Perform brazing and silver soldering
IND MCS4 08 1221 Prepare and produce specialized coatings

1.4. Duration of the TVET-Program

The Program will have duration of **435 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.

No	Unit competency	TVET Institution training		Cooperative training	Total hours	Remarks
		Theory	Practical			
1.	Plan and organize work	20	10	5	35	
2.	Install and commission equipment and machineries	20	10	20	50	
3.	Estimate manufacturing and maintenance cost	20	20	20	60	
4.	Supervise and guide Computer-Integrated Manufacturing (CIM) production Operations	30	20	20	70	
5.	Check advanced pneumatic and hydraulic system	20	10	20	50	
6.	Perform automated thermal cutting	30	20	20	70	
7.	Perform brazing and silver soldering	20	20	20	60	
8.	Prepare and Produce Specialized Coatings	15	10	15	40	
	Total Hrs	**175**	**120**	**140**	**435**	

1.5. Qualification Level and Certification

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

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

1.6. Target Groups

Any citizen with disability who meets the entry requirements under items 1.7 and capable of participating in the training activities is entitled to take part in the Program.

1.7 Entry Requirements

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

1.8 Mode of Delivery

This TVET-Program is characterized as a formal Program on middle level technical skills. The mode of delivery is co-operative training. The time spent by the trainees in the real work place/ industry will give them enough exposure to the actual world of work and enable them to get hands-on experience.

The co-operative approach will be supported with school-based lecture-discussion, simulation and actual practice. These modalities will be utilized before the trainees are exposed to the industry environment.

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

1.9. TVET-Program Structure

Unit of Competence		Module Code & Title		Training Outcomes	Duration (In Hours)
IND MCS4 01 1221	Plan and Organize Work	**IND MCS4 M01 0322**	Planning and Organizing Work	• Set objectives. • Plan and schedule work activities. • Implement work plans. • Monitor work activities. • Review and evaluate work plans and activities	35
IND MCS4 02 1221	Install and commission equipment and machineries	**IND MCS4 M02 0322**	Installing and commissioning equipment and machineries	• Plan and prepare for testing and commissioning of systems Conduct production machineries and commissioning performance • Ensure testing the plant and machineries • Analyze condition monitoring results • Develop recommendations	50
IND MCS4 03 1221	Estimate Manufacturing and Maintenance Cost	**IND MCS4 M03 0322**	Estimating Manufacturing and Maintenance Cost	• Collect information. • Prepare a simple cost estimate • Establish physical resource requirements • Develop estimated product/project costs. • Verify cost estimate.	60

IND MCS4 04 1221	Supervise and Guide Computer-Integrated Manufacturing (CIM) Production Operations	**IND MCS4 M04 0322**	Supervising and Guiding Computer-Integrated Manufacturing (CIM) Production Operations	• Interpret the design brief or scope of production including CIM system. • Prepare production process including possible CIM system. • Perform supervision of conventional and /or CIM supported production. • Assure quality production process.	70
IND MCS4 05 1221	Check Advanced Pneumatic and Hydraulic System	**IND MCS4 M05 0322**	Checking Advancing Pneumatic and Hydraulic System	• Check advanced pneumatic and hydraulic system components. • Identify, repair or replace faulty pneumatic and hydraulic system components. • Quality Assure and maintain work.	50
IND MCS4 06 1221	Perform Automated Thermal Cutting	**IND MCS4 M06 0322**	Performing Automated Thermal Cutting	• Set up material. • Set up and use automated cutting machine. • Use automated thermal cutting machine.	70
IND MCS4 07 1221	Perform Brazing and Silver Soldering	**IND MCS4 M07 0322**	Performing Brazing and Silver Soldering	• Prepare materials and equipment • Braze and silver solder • Inspect joints	60
IND MCS4 08 1221	Prepare and Produce Specialized Coatings	**IND MCS4 M08 0322**	Preparing and Producing Specialized Coatings	• Undertake mask and jig work • Determine operating parameters • Pre-treat and treat work	40
					435

*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 A Level and above who have satisfactory practical experiences or equivalent qualifications.

LEARNING MODULE 01
TVET-PROGRAMME TITLE: **MECHANICS LEVEL IV**
MODULE TITLE: **Planning and Organizing Work**
MODULE CODE: **IND MCS4 M01 0322**
NOMINAL DURATION: **35 Hours**
MODULE DESCRIPTION: This module covers the knowledge skill and attitude required in planning and organizing work activities in a production application. It may be applied to a small independent operation or to a section of a large organization.
LEARNING OUTCOMES At the end of the module the trainee will be able to: **LO1**.Set objectives. **LO2**.Plan and schedule work activities. **LO3**.Implement work plans. **LO4**. Monitor work activities. **LO5**. Review and evaluate work plans and activities
MODULE CONTENTS: **LO1.Set objectives.** 1.1. Planning Objectives. 1.2. Stating objectives as measurable targets. 1.3. Reflecting support and commitment of team members. 1.4. Identifying realistic and attainable objectives. **LO2.Plan and schedule work activities.** 2.1. Identifying and prioritizing tasks/work activities. 2.2. Breaking down tasks/work activities into steps. 2.3. Assigning task/work activities. 2.4. Allocating resources. 2.5. Coordinating schedule work activities. **LO3.Implement work plans.** 3.1. Identifying work methods and practices. 3.2. Implementing Work plans. **LO4. Monitor work activities.** 4.1. Monitoring and comparing work activities. 4.2. Monitoring Work performance.

4.3. Reporting and recommending deviations from work activities.

4.4. Compiling reporting requirements.

4.5. Observing timeliness of report.

4.6. Establishing and maintaining files.

LO5.Review and evaluate work plans and activities.

5.1. Reviewing work plans, strategies and implementation.

5.2. Doing review based on comprehensive consultation.

5.3. Providing results of review to concerned parties

5.4. Conducting performance appraisal.

5.5. Preparing and documenting performance appraisal report.

5.6. Preparing and presenting recommendations

5.7. Implementing feedback mechanisms.

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.Set objectives.**

- **Objectives** are planned consistent with and linked to work activities in accordance with organizational aims.
- Objectives are stated as measurable targets with clear time frames.
- Support and commitment of team members are reflected in the objectives.
- Realistic and attainable objectives are identified.

LO2.Plan and schedule work activities.

- .Tasks/work activities to be completed are identified and prioritized as directed.
- Tasks/work activities are broken down into steps in accordance with set time frames and achievable components.
- Task/work activities are assigned to appropriate team or individuals in accordance with agreed functions.
- Resources are allocated as per requirements of the activity.
- Schedule of work activities is coordinated with personnel concerned.

LO3.Implement work plans.

- Work methods and practices are identified in consultation with personnel concerned.
- Work plans are implemented in accordance with set time frames, resources and standards.

LO4. Monitor work activities.

- Work activities are monitored and compared with set objectives.
- Work performance is monitored.
- Deviations from work activities are reported and recommendations are coordinated with appropriate personnel and in accordance with set standards.
- Reporting requirements are complied with in accordance with recommended format.
- Timeliness of report is observed.
- Files are established and maintained in accordance with standard operating procedures.

LO5.Review and evaluate work plans and activities.

- Work plans, strategies and implementation are reviewed based on accurate, relevant and current information.
- Review is done based on comprehensive consultation with appropriate personnel on outcomes of work plans and reliable feedback.
- Results of review are provided to concerned parties and formed as the basis for adjustments/simplifications to be made to policies, processes and activities.
- Performance appraisal is conducted in accordance with organization rules and regulations.
- Performance appraisal report is prepared and documented regularly as per organization requirements.
- Recommendations are prepared and presented to **appropriate personnel/authorities**.
- **Feedback mechanisms** are implemented in line with organization policies.

Annex: Resource Requirements

IND MCS4 M01 0322 Planning and organizing work.				
Item No.	Category/Item	Description/ Specifications	Quantity	Recommended Ratio (Item: Learner)
A.	**Learning Materials**			
1.	TTLM	To be prepared by a trainer	25	1:1

2.	Textbooks	-	-	-
3.	Reference Books	• Narsimhan, S.L., McLeavey, D.W.&Billigtion. P.J., Productio planning and Inventory Control, Prentice Hall of India- New Delhi. 2nd edition 1995 • Buffa, E.S. and Sarin, R., Modern production and operations management, 8th editon, John Wiley.	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
C.	**Consumable Materials**			
1.	Paper	A4	As required	1:25
2.	White board	STD	1	1:25
3.	White board marker	Max-fill		
D.	**Tools and Equipments**			
1.	LCD Projector	1500 Lumens	1	1:25
2.	Screen	1280x1024mm	1	1:25

LEARNING MODULE 02
TVET-PROGRAMME TITLE: MECHANICS Level IV
MODULE TITLE: Installing and commissioning equipment and machineries
MODULE CODE: **IND MCS4 M02 0322**
NOMINAL DURATION. **50 Hours**
MODULE DESCRIPTION: This module describes the outcomes required to plan and implement the testing and commissioning of plant and machineries. Data analysis results and developing recommendations based on the analysis of plant equipment and machineries monitoring program condition. The ability to interpret technical information, identify and assess

hazards and perform technical testing procedures are essential to performance.

LEARNING OUTCOMES

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

LO1. Plan and prepare for testing and commissioning of systems

LO2. Conduct production machineries and commissioning performance

LO3. Ensure testing the plant and machineries

LO4.Analyze condition monitoring results

LO5.Develop recommendations

MODULE CONTENTS:

LO1. Plan and prepare for testing and commissioning of systems

1.1. Checking plans for the section to be testing.

1.2. Identifying and interpreting the operating system requirements.

1.3. Selecting testing tools and equipment for accuracy.

1.4. Identifying and assessing potential hazards.

1.5. Confirming testing and commissioning tasks.

1.6. Checking vacuum testing tasks.

LO2. Conduct production machineries and commissioning performance

1.1. Selecting and installing tensioning and measuring equipment.

1.2. Selecting and fitting level gauges to test equipment.

1.3. Testing procedures to organizational and statutory requirements.

1.4. Locating accurately and reporting and testing failed gear box, oil tank and screws

1.5. Testing, locating and reporting failed maintenance holes,

1.6. Arranging oil disinfection

1.7. Disposing contaminated or damaged oil.

LO3. Ensure testing the plant and machineries

3.1. Ensuring the testing of plant and machineries

3.2. Restoring the work site to meet environmental.

3.3. Checking maintaining and storing equipment tools and materials.

LO4. Analyze condition monitoring results

4.1 Examining and analyzing records/graphs/results of condition monitoring.

4.2 Undertaking necessary calculations/computations.

4.3 Maintaining calibration records and certificates

4.4 Undertaking appropriate reports/determinations of analyses.

LO5. Develop recommendations

5.1 Developing recommendations

5.2 Reporting appropriate recommendations

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. Prepare materials and equipment

- Check plans for the section to be tested and features located on site.
- The system operation requirements are identified and interpreted correctly.
- Testing **tools and equipment** are selected, checked and used for accuracy.
- **Potential hazards** are identified and assessed and required preventative measures taken.
- Testing and commissioning tasks are confirmed from **relevant documentation** and scheduled appropriately.
- Vacuum testing tasks are checked from relevant documentation and scheduled appropriately.

LO 2.Braze and silver solder

- Tensioning and measuring equipment are selected and installed correctly.
- Level gauges of the correct range are selected and fitted to test equipment.
- **Testing procedures** are carried out according to **organizational and statutory requirements**.
- Failed gear box, oil tank and screws are located accurately and reporting and testing rescheduled.
- Failed maintenance holes, inspection shafts, maintenance shafts or other access structures and rescheduled testing are located and reported accurately.
- Oil disinfection is arranged according to organizational and statutory requirements.
- Contaminated or damaged (burned) oil is disposed of according to organizational requirements.

LO 3.Inspect joints

- The **testing of plant and machineries** is ensured to be operational according to specifications and organizational procedures.
- The work site is restored to meet environmental and organizational requirements.
- Equipment tools and materials are checked, maintained and stored according to manufacturer guidelines and organizational procedures.

LO4. Analyze condition monitoring results

- Records/graphs/results of condition monitoring are examined and analyzed and problem areas are identified.
- Necessary **calculations**/computations are undertaken.
- Calibration records and certificates are maintained in accordance with organizational and statutory requirements
- Appropriate reports/determinations of analyses are undertaken to prescribe site procedure.

LO5. Develop recommendations

- Recommendations are developed based on previous history, results, specifications and **legislative requirements**.
- Recommendations are reported to appropriate authority.

Annex: Resource Requirements

IND MCS4 M02 0322 Installing and commissioning equipment and machineries				
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. 2. Moubray, John, Reliability - Centered Maintenance, 2nd ed., Industrial Press Inc., NY, 1997.	5	1:5
3.	Text books	Neale, M. J., The Tribology Handbook, 2nd ed., Butterworths - Heinmann Publishing Ltd., 1995.	5	1:5
4.	Journals/Publication /Magazines			
B.	**Learning Facilities & Infrastructure**			
1.	Lecture Room	Standard		1:25
2.	Library	Standard		1:25
3.	Laboratory	Standard		1:25
C.	**Consumable Materials**			
1.	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**			
1.	Communication equipment			1:5
2.	Personal protective equipment	STD		1:5
3.	Testing equipment	STD		1:5
4.	Line plugs	STD		1:5
5	Hand and power tools,Level gauges	STD	As require	1:5

LEARNING MODULE 03
TVET-PROGRAMME TITLE: **MECHANICS LEVEL IV**
MODULE TITLE: **Estimating Manufacturing and Maintenance Cost**
MODULE CODE: **IND MCS4 M03 0322**
NOMINAL DURATION: **60 Hours**
MODULE DESCRIPTION: This module covers the knowledge, skills and attitude required in applying principles and concepts associated with the preparation of a cost estimate for a product or project. To be manufactured or maintained /repaired. It includes materials cost, labor cost together with the application of relevant overhead cost and margins.
LEARNING OUTCOMES At the end of the module the trainee will be able to: **LO1**. Collect information. **LO2**. Prepare a simple cost estimate **LO3**. Establish physical resource requirements **LO4**.Develop estimated product/project costs. **LO5**. Verify cost estimate.
MODULE CONTENTS: **LO1. Collect information.** 1.1. Obtaining Tender/cost estimate brief. 1.2. Reading and understanding project plans and specifications. 1.3. Making measurements. 1.4. Obtaining and agreeing labor unit cost. 1.5. Obtaining and analyzing logistic support contracts, supply agreements. 1.6. Obtaining details of propos warehousing. 1.7. Converting Information to usable form and Storing for retrieval **LO2. Prepare a simple cost estimate** 2.1. Identifying and interpreting Relevant costing data 2.2. Obtaining Organizational production costs 2.3. Preparing Cost estimates 2.4. Estimating labor, material, overhead, expense, production costs **LO3. Establish physical resource requirements.** 3.1. Identifying physical resource requirements. 3.2. Calculating lists of materials.

3.3. Establishing quantities against project.

3.4. Obtaining Supplier prices.

3.5. Identifying and costing equipment.

LO4.Develop estimated product/project costs.

4.1. Selecting and applying labor rates and material costs.

4.2. Determining and applying estimates of unit costs.

4.3. Identifying and applying Costs to the project.

4.4. Applied Company overhead recovery and margins.

4.5. Calculating complete estimate project costs.

LO5. Verify cost estimate.

5.1. Sourcing actual cost information.

5.2. Comparing actual costs with estimate cost.

5.3. Explaining deviations.

5.4. Obtaining Assistance/approval from management

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. Collect information.

- Tender/cost estimate brief is obtained and key requirements identified within established organizational framework, procedures and routines
- Appropriate project plans and specifications are read and understood based on requirements
- Measurements are made and quantities identified from plans and specifications and which conforms to standards industry practice
- Labor unit cost projections are obtained and agreed based on labour agreements
- Logistic support contracts, supply agreements or equivalent are obtained and analyzed due to organizational procedures
- Details of proposed warehousing or spare part storage and physical distribution systems and related cost factors are obtained to requirements
- Information is converted to usable form and stored ready for retrieval and application due to applied standards

LO2. Prepare a simple cost estimate

- Relevant costing data is identified and interpreted from the tender/cost estimate documents.
- Organizational production costs are obtained
- Cost estimates are prepared according to established organizational framework, procedures and routines
- Estimated labor, material, overhead, expense, production costs…etc.

LO3. Establish physical resource requirements.

- Physical resource requirements are identified due to requirements
- Lists of materials are produced and quantities calculated based on work plan
- Quantities against project or standard contracts are established due to specifications
- Supplier prices for materials and consumables are obtained according to organizational procedures
- Plant or equipment requirements are identified and costed.

LO4.Develop estimated product/project costs.

- Appropriate labor rates and material costs are selected and applied by labour laws
- Estimates of unit costs, as appropriate, are determined and applied based on requirements
- Costs to the project of work cover, environmental protection agency requirements, seeking approvals, waste management fees and other statutory or additional costs are identified and applied to standard
- Company overhead recovery and margins are applied based on specifications
- Completed estimated **project costs** for inclusion in a maintenance and repair plan or tender or bill are calculated due to requirements

LO5. Verify cost estimate.

- Actual cost information is sourced from a completed project and compared with specifications
- Actual costs are compared with estimated cost to identify deviations.
- Deviations are explained according to established organizational framework, procedures and routines.
- Assistance/approval is obtained from management.

Annex; resource requirements

IND MCS4 M03 0322 Estimating Manufacturing and Maintenance Cost				
Item No.	Category/Item	Description/ Specifications	Quantity	Recommended Ratio (Item: Learner)
A.	**Learning Materials**			
1.	TTLM	To be prepared by a trainer	25	1:1
2.	Textbooks	-	-	-
3.	Reference Books	1. B.S.Dhillon, Engineering Maintenance, CRC Press LLC, London, 2002. 2. Sushil Kumar Srivastava, Maintenance Engineering and Management, S.chand Company Ltd., 1998. 3. James A. Brimson, Activity Accounting: An Activity Based Costing Approach, Jul 7, 199.	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.	Paper	A4	1desta	1:25
2.	White board	STD	1	1:25
3.	White board marker	Max-fill	1packet	
D.	**Tools and Equipments**			
1.	LCD Projector	1500 Lumens	1	1:25
2.	Screen	1280x1024mm	1	1:25

LEARNING MODULE 04

TVET-PROGRAMME TITLE: **MECHANICS LEVEL IV**

MODULE TITLE: **Supervising and Guiding Computer-Integrated Manufacturing (CIM) Production Operations**

MODULE CODE: **IND MCS4 M04 0322**

NOMINAL DURATION**: 70 Hours**

MODULE DESCRIPTION: This module covers the competency required of supervising and guiding production operations including control of machine and processes and the capture of manufacturing data through conventional or CIM processes

LEARNING OUTCOMES

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

LO1 .Interpret the design brief or scope of production including CIM system.

LO2.Prepare production process including possible CIM system.

LO3.Perform supervision of conventional and /or CIM supported production.

LO4.Assure quality production process.

MODULE CONTENTS:

LO1.Interpret the design brief or scope of production including CIM system.

1.1. Establishing features and extent of integration of the CIM system.

1.2. Establishing technical, commercial and environmental parameters.

1.3. Consulting technical managers and senior design engineers.

1.4. Considering OHS, regulatory requirements and enterprise procedures

1.5. Collecting and presenting preliminary advice on feasibility of manual or CIM project.

LO2.Prepare production process including possible CIM system.

2.1. Performing investigations and measurements.

2.2. Carrying out modeling and calculations using software and validation techniques.

2.3. Generating conventional and CIM production solutions.

2.4. Checking feasibility and evaluate solutions.

2.5. Determining social and sustainability implications of solutions.

2.6. Reviewing concept proposals.

LO3. Perform supervision of conventional and /or CIM supported production.

3.1. Planning conventional production processes.

3.2. Providing documentation, drawings, specifications and instructions.

3.3. Consulting client and stakeholders.

3.4. Preparing draft production process.

LO4.Assure quality production process.

4.1. Applying Production standards (preferable ISO 9001 and 14001).

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: Interpret the design brief or scope of production including CIM system

- Required features and extent of integration of the CIM system are established in consultation with the client based on applicable operational regulations
- Technical, commercial and environmental parameters are established to the scope of work in accordance with organizational procedures
- Technical managers and senior design engineers are consulted in determining a production process in compliance with engineering standards
- OHS, regulatory requirements and enterprise procedures relevant to scope of work
- Preliminary advice on feasibility of manual or possible CIM project are collected and presented to client based on engineering environment

LO2. Prepare production process including possible CIM system

- Investigations and measurements are performed based on scope of work and operational standards
- Required modeling and calculations are carried out using appropriate software and validation techniques according to production specifications
- A range of conventional and CIM production solutions are generated using appropriate innovative and creative engineering specifications
- Feasibility and evaluate solutions are checked against design criteria ensuring conformity to standards and codes, technical, economic and OHS requirements
- Social and sustainability implications of solutions are determined according to organizational specifications
- Concept proposals is reviewed with client and identify preferred solution according to operational procedures

LO3. Perform supervision of conventional and /or CIM supported production

- Conventional production processes are planned in comparison to CIM design based on results of external feasibility study and organizational requirements
- Documentation, drawings, specifications and instructions are provided in accordance with industry standards
- Client and stakeholders are consulted in accordance with company procedures
- Approved drafted production process is prepared for implementation according to operational requirements and standards.

LO4. Assure quality production process

- Production standards are applied (preferable ISO 9001 and 14001…) during the manufacturing process according to industry requirements

Annex: Resource Requirements

IND MCS4 M04 0322 Supervising And Guiding Computer-Integrated Manufacturing (CIM) Production Operations.				
Item No.	Category/Item	Description/ Specifications	Quantity	Recommended Ratio (Item: Learner)
A.	**Learning Materials**			
1.	TTLM	To be prepared by a trainer	5	1:5
2.	Textbooks	-	-	-
3.	Reference Books	-Mikell P. Groover Zimmer-Automation Computer-Integrated Manufacturing-Prentice Hall	5	1:5
4.	Journals/Publication/Magazines	CADCAMCIM Radhakrishnan Subramanyan and Raju.pdf	5	1:5
4.1	Integrated Manufacturing Systems	Dr Y.H. Chen and Dr Ian Gibson,2003		
B.	**Learning Facilities & Infrastructure**			
1.	Lecture Room	5m*7m	1	1:25
2.	Library	8mX20m	1	1:25
C.	**Consumable Materials**			
1.	Paper	A4	1rim	1:25
2.	White board	STD	1	1:25
3.	White board marker	Max-fill	1packet	-
D.	**Tools and Equipments**			
1.	LCD Projector	1500 Lumens	1	1:25
2.	Screen	1280x1024mm	1	1:25
3.	CNC Lathe machine	STD	5	1:5
4.	CNC Milling machine	STD	5	1:5
5.	Simulation soft wear		1	1:25
6.	Computer		25	1:1

LEARNING MODULE 05
TVET-PROGRAMME TITLE: **MECHANICS LEVEL IV**
MODULE TITLE: **Checking Advancing Pneumatic and Hydraulic System**
MODULE CODE: **IND MCS4 M05 0322**
NOMINAL DURATION**:** **50 Hours**
MODULE DESCRIPTION: This module covers checking pneumatic and hydraulic system components, and identifying and repairing or replacing faulty components.
LEARNING OUTCOMES At the end of the module the trainee will be able to: **LO1**. Check advanced pneumatic and hydraulic system components. **LO2**.Identify, repair or replace faulty pneumatic and hydraulic system components. **LO3**. Quality Assure and maintain work.
MODULE CONTENTS: **LO1. Check advanced pneumatic and hydraulic system components**. 1.1. Identifying advanced pneumatic and hydraulic system components. 1.2. Understanding characteristics and operational function of system component. 1.3. Inspecting and testing operational function of each component. 1.4. Assessing correct operation of component **LO2. Identify, repair or replace faulty pneumatic and hydraulic system components.** 2.1. Confirming faulty system components. 2.2. Dismantling and repairing faulty components. 2.3. Selecting replacement parts. 2.4. Reassembling and verifying system components. 2.5. Confirming correct operation of the pneumatic system. 2.6. Adopting follow-up procedures. 2.7. Completing service reports. **LO3. Quality Assure and maintain work.** 3.1. Testing and recording components and lines. 3.2. Adopting appropriate follow-up procedures. 3.3. Documenting test equipment and procedures. 3.4. 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. Check advanced pneumatic and hydraulic system components.

- Advanced pneumatic and hydraulic system **components** are identified correctly.
- The characteristics and operational function of each system component are understood.
- The operational function of each component is inspected and tested.
- Correct operation of each component is assessed against specifications.

LO2. Identify, repair or replace faulty pneumatic and hydraulic system components.

- Faulty system components are localized and malfunction is confirmed by inspection and testing using fluid power principles, procedures and safety requirements.
- Faulty system components are dismantled and repaired to manufacturers'/site specifications.
- Replacement parts are selected from manufacturers' catalogue according to required specifications.
- System components are reassembled and verified for correct operation and tested against specifications.
- Correct operation of the pneumatic system is confirmed to standard operating procedures.
- Appropriate follow-up procedures are adopted according to standard operating procedures.
- Where appropriate, service reports are completed using standard operating procedures.

LO3. Quality Assure and maintain work.

- All components and lines are tested and recorded on functionality and leakages due to operational and test pressure requirements
- Appropriate follow-up procedures are adopted according to standard operating procedures
- **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 MCS4 M05 0322 Checking Advanced Pneumatic And Hydraulic System.				
Item No.	Category/Item	Description/ Specifications	Quantity	Recommended Ratio (Item: Learner)
A.	**Learning Materials**			
1.	TTLM	To be prepared by a trainer	25	1:1
2.	Textbooks	• Hydraulics and Pneumatics by Andrew A. Parr, ISBN: 0750644192, Publisher: Elsevier Science & Technology Books · Pub. Date: March 1999	5	1:5
3.	Reference Books	-	-	-
4.	Journals/Publication/Magazines	-	-	-
B.	**Learning Facilities & Infrastructure**			
1.	Lecture Room	5m*7m	1	1:25
2.	Library	8mX20m	1	1:25
C.	**Consumable Materials**			
1.	paper	A4	1desta	1:25
2.	White board	STD	1	1:25
3.	White board marker	Max-fill		
D.	**Tools and Equipments**			
1.	LCD Projector	1500 Lumens	1	1:25
2.	Screen	1280x1024mm	1	1:25
3.	Pressure meter	STD	5	1:5
4.	Leakage detectors	STD	5	1:5
5.	Multi meters	STD	5	1:5
6.	Process switches	STD	5	1:5

LEARNING MODULE 06
TVET-PROGRAMME TITLE: **MECHANICS LEVEL IV**
MODULE TITLE: **Performing Automated Thermal Cutting**
MODULE CODE: **IND MCS4 M06 0322**
NOMINAL DURATION: **70 Hours**
MODULE DESCRIPTION: This module covers setting up and using single and multi-headed automated thermal cutting machines.
LEARNING OUTCOMES At the end of the module the trainee will be able to: **LO1** Set up material. **LO2.**Set up and use automated cutting machine. **LO3**.Use automated thermal cutting machine.
MODULE CONTENTS: **LO1.Set up material.** 1.1. Setting up Material. **LO2.Set up and use automated cutting machine.** 2.1. Selecting cutting medium. 2.2. Determining process requirements. 2.3. Setting up machine safely 2.4. Selecting and loading correct program. 2.5. Establishing machine datum. **LO3.Use automated thermal cutting machine.** 3.1. Igniting cutting medium. 3.2. Starting machine using correct sequence 3.3. Using powder marking and other tracing devices. 3.4 Observing correct shut-down procedure.

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.Set up material.

- **Material** is set up, including correct procedures for stack cutting and nesting to minimize waste.

LO2.Set up and use automated cutting machine.

- Appropriate **cutting medium** is selected and set to specification.
- Process requirements are determined from specifications or instructions.
- **Machine** is set up safely to specifications using standard operating procedures.
- **Correct program** is selected and loaded to standard operating procedure.
- Machine datum are established to specifications.

LO3.Use automated thermal cutting machine.

- Where required, cutting medium is ignited following standard operating procedures.
- Machine is started using correct sequence and procedure.
- Powder marking and other **tracing devices** are used as required to standard operating procedures.
- Correct shut-down procedure is observed in accordance with standard operating procedures.

Annex: Resource Requirements

IND MCS4 M06 0322 Performing Automated Thermal Cutting				
Item No.	Category/Item	Description/ Specifications	Quantity	Recommended Ratio (Item: Learner)
A.	**Learning Materials**			
1.	TTLM	To be prepared by a trainer	25	1:1
2.	Textbooks	-		
3.	Reference Books	Integration and Automation of Manufacturing Systems by: Hugh Jack © Copyright 1993-2001, Hugh Jack	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
C.	**Consumable Materials**			
1.	paper	A4	1desta	1:25
2.	White board	STD	1	1:25
3.	White board marker	Max-fill		
4.	Oxygen gas	In cylinder	5	1:5
5.	Acetylene gas	In cylinder	5	1:5
D.	**Tools and Equipments**			
1.	LCD Projector	1500 Lumens	1	1:25
2.	Screen	1280x1024mm	1	1:25
3.	Acetylene cylinder	STD	5	1:5
4.	Oxygen cylinder	STD	5	1:5
5.	Cutting torch	STD	5	1:5
6.	Lighter		5	1:5
7.	Tip cleaner	Different dia.	5	1:5

LEARNING MODULE 07
TVET-PROGRAMME TITLE: MECHANICS Level IV
MODULE TITLE: **Performing Braze and Silver Soldering**
MODULE CODE: **IND MCS4 M07 0322**
NOMINAL DURATION**. 60 Hours**
MODULE DESCRIPTION: This module covers performing brazing (including braze welding) and/or silver soldering. It includes the preparation of materials and equipment and the inspection of the completed work.
LEARNING OUTCOMES At the end of the module the trainee will be able to: **LO1.** Prepare materials and equipment **LO2.**Braze and silver solder **LO3.**Inspect joints
MODULE CONTENTS: **LO1. Prepare materials and equipment** 1.1. Determining job requirements from specifications. 1.2. Preparing materials 1.3. Assembling /aligning materials. 1.4. Identifying distortion prevention measures and taken appropriate action. 1.5. Assembling and set up safely heating equipment. 1.6. Selecting and preparing consumables correctly 1.7. Undertaking and verifying test run. **LO2. Braze and silver solder** 2.1. Selecting the correct process to meet specifications. 2.2. Preheating materials 2.3. Appling consumables using correct techniques. 2.4. Appling jointing material correctly and in appropriate quantities 2.5. Annealing material temperature using correct and appropriate techniques. **LO3. Inspect joints** 3.1. Removing excess jointing materials 3.2. Undertaking inspection of joints 3.3. Reporting/recording inspection 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	❖ Introduce the trainees with their peers

			member ❖ Inform the group members to speak loudly	
Exercise	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process/practical training ❖ Introduce new and relevant vocabularies	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process/ practical training	❖ Assign peer trainees ❖ Use additional nominal hours if necessary
Individual assignment	❖ prepare the assignment questions in large text ❖ Encourage the trainees to prepare and submit the assignment in large texts ❖ Make available recorded assignment questions ❖ Facilitate the trainees to prepare and submit the assignment in soft or hard copy	❖ Use sign language interpreter ❖ Provide briefing /orientation on the assignment ❖ Provide visual recorded material	❖ Provide briefing /orientation on the assignment ❖ Provide visual recorded material	

ASSESSMENT METHODS:				
Interview		❖ Use sign language interpreter ❖ Ensure or conform whether the proper communication was conducted with the trainee through the service of the sign language interpreter ❖ Use short and clear questioning ❖ Time extension	❖ Speak loudly ❖ Using sign language interpreter if necessary	❖ Use written response as an option for the trainees having speech challenges
Written test	❖ Prepare the exam in large texts ❖ Use interview as an option if necessary ❖ Prepare the exam in audio format ❖ Assign human reader ❖ (if necessary) ❖ Time extension	❖ Prepare the exam using short sentences, multiple choices, True or False, matching and short answers ❖ Avoid essay writing ❖ Time extension	❖ Prepare the exam using short sentences, multiple choices, true or false, matching and short answers if necessary.	❖ Use oral response as an option to give answer for trainees having severe upper limb impairment ❖ Time extension for trainees having severe upper limb impairment
Demonstration/Observation	❖ Brief the instruction or provide them in large text ❖ Time extension	❖ Use sign language interpreter ❖ Brief on the instruction of the exam ❖ Provide activity-based/ practical assessment method ❖ Time extension	❖ Provide activity based assessment ❖ Brief on the instruction of the exam ❖ Use loud voice ❖ Time extension	❖ Provide activity based assessment ❖ Conduct close follow up ❖ Time extension

ASSESSMENT CRITERIA:

LO1. Prepare materials and equipment

- Job requirements are determined from specifications and/ or instructions.
- Materials are correctly prepared using appropriate tools and techniques.
- Materials are correctly assembled/aligned to meet specifications as required.
- Distortion prevention measures are identified and appropriate action is taken as required.
- Heating equipment is assembled and set up safely and correctly in accordance with standard operating procedures.
- Correct and appropriate consumables are selected and prepared.
- Test run is undertaken and verified as required.

LO 2.Braze and silver solder

- The correct process is selected to meet specifications.
- Materials are preheated as required.
- Consumables are applied using correct techniques.
- Jointing material is applied correctly and in appropriate quantities to meet job/specifications.
- Material temperature is annealed using correct and appropriate techniques.

LO 3.Inspect joints

- Excess jointing materials are removed using correct and appropriate techniques.
- Inspection of joints is undertaken to standard operating procedures.
- Inspection results are reported/recorded using standard operating procedures as required.

Annex: Resource Requirements

IND MCS4 M07 0322 Performing Brazing and Silver Soldering				
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	• A.C. Davies, The Science and Practice of Welding, Vol.1 and Vol.2, Cambridge University Press, 1992. • Bowditch, William A., Welding Technology Fundamentals, The Good heart willcox company, Inc. 1991.	5	1:5
3	Text books			
4.	Journals/Publication/ Magazines			
B.	**Learning Facilities & Infrastructure**			
1.	Lecture Room	Standard		1:25
2.	Library	Standard		1:25
3.	Laboratory	Standard		1:25
C.	**Consumable Materials**			
1.	• Fluxes (resin or powder), all types of silver solder and brazing grades, etc.	STD		1:1
D.	**Tools and Equipments**			
1.	Oxy acetylene and fuel gas connections	STD	As required	1:5
2.	Acetylene and oxygen Cylinders	STD	5	1:5
3.	Hoses	Pcs.	5	1:5
4.	Tips And Nozzles	STD/different dia.	5	1:5

LEARNING MODULE 08
TVET-PROGRAMME TITLE: MECHANICS Level –IV
MODULE TITLE: Preparing and Producing Specialized Coatings
MODULE CODE: **IND MCS4 M08 0322**
NOMINAL DURATION. **40 Hours**
MODULE DESCRIPTION: This module covers the skill, knowledge and attitudes undertaking masking and jig work, determining operational parameters, and pre-treating and treating work.
LEARNING OUTCOMES At the end of the module the trainee will be able to: **LO1.** Undertake mask and jig work **LO2.**Determine operating parameters **LO3.** Pre-treat and treat work
MODULE CONTENTS: **LO1. Undertake mask and jig work** 1.1 Securing and masking Jigs to adherent and stable. 1.2 Incorporating effectively necessary auxiliary electrodes and shields. 1.3 Manufacturing necessary jigs and shields. **LO2. Determine operating parameters** 2.1. Appling plating knowledge and/or specifications correctly. 2.2 Selecting materials for coating based on the type of material and standard. **LO3. Pre-treat and treat work** 3.1.Selecting machines for pre-treatment of work 3.2. Treating work with in specifications.

Learning Methods:				
For none impaired trainees	**Reasonable Adjustment for Trainees with Disability (TWD)**			
	Low Vision	**Deaf**	**Hard of hearing**	**Physical impairment**
Lecture-discussion	❖ Provide large print text ❖ Prepare the lecture in **Audio/video** ❖ Organize the class room seating arrangement to be accessible to trainees ❖ Write short notes on the black/white board using large text ❖ Make sure the luminosity of the light of class room is kept ❖ Use normal tone of voice ❖ Encourage trainees to record the lecture in audio format ❖ Provide Orientation on the physical feature of the work shop ❖ Summarize main points	❖ Assign sign language interpreter ❖ Arrange the class room seating to be conducive for eye to eye contact ❖ Make sure the luminosity of the light of class room is kept ❖ Introduce new and relevant vocabularies ❖ Use short and clear sentences ❖ Give emphasis on visual lecture and ensure the attention of the trainees ❖ Avoid movement during lecture time ❖ Present the lecture in video format ❖ Summarize main points	❖ Organize the class room seating arrangement to be accessible to trainees ❖ Speak loudly ❖ Ensure the attention of the trainees ❖ Present the lecture in video format ❖ Ensure the attention of the trainees	❖ Organize the class room seating arrangement to be accessible for wheelchairs users. ❖ Facilitate and support the trainees who have severe impairments on their upper limbs to take note ❖ Provide Orientation on the physical feature of the work shop
Demonstration	❖ Conduct close follow up ❖ Use verbal description ❖ Provide special attention in the process of guidance ❖ facilitate the support of peer trainees ❖ Prepare & use simulation	❖ use Sign language interpreter ❖ Use video recorded material ❖ Ensure attention of the trainees ❖ Provide structured training ❖ Show clear and short method ❖ Use gesture ❖ rovide tutorial support (if necessary)	❖ Illustrate in clear & short method ❖ Use Video recorded material ❖ Ensure the attention of the trainees ❖ rovide tutorial support (if necessary)	❖ Facilitate and support the trainees having severe upper limbs impairment to operate equipments/ machines ❖ Assign peer trainees to assist ❖ Conduct close follow up ❖ rovide tutorial support (if necessary
Group discussion	❖ Facilitate the integration of trainees with group members ❖ Conduct close follow up ❖ Introduce the trainees with other group member ❖ Brief the thematic issues of the work	❖ Use sign language interpreters ❖ Facilitate the integration of trainees with group members ❖ Conduct close follow up ❖ Introduce the trainees with other group member	❖ Facilitate the integration of trainees with group members ❖ Conduct close follow up ❖ Introduce the trainees with other group member ❖ Inform the group members to speak loudly	❖ Introduce the trainees with their peers

Exercise	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process/practical training ❖ Introduce new and relevant vocabularies	❖ Conduct close follow up and guidance ❖ Provide tutorial support if necessary ❖ provide special attention in the process/ practical training	❖ Assign peer trainees ❖ Use additional nominal hours if necessary
Individual assignment	❖ prepare the assignment questions in large text ❖ Encourage the trainees to prepare and submit the assignment in large texts ❖ Make available recorded assignment questions ❖ Facilitate the trainees to prepare and submit the assignment in soft or hard copy	❖ Use sign language interpreter ❖ Provide briefing /orientation on the assignment ❖ Provide visual recorded material	❖ Provide briefing /orientation on the assignment ❖ Provide visual recorded material	

ASSESSMENT METHODS:				
Interview		❖ Use sign language interpreter ❖ Ensure or conform whether the proper communication was conducted with the trainee through the service of the sign language interpreter ❖ Use short and clear questioning ❖ Time extension	❖ Speak loudly ❖ Using sign language interpreter if necessary	❖ Use written response as an option for the trainees having speech challenges
Written test	❖ Prepare the exam in large texts ❖ Use interview as an option if necessary ❖ Prepare the exam in audio format ❖ Assign human reader ❖ (if necessary) ❖ Time extension	❖ Prepare the exam using short sentences, multiple choices, True or False, matching and short answers ❖ Avoid essay writing ❖ Time extension	❖ Prepare the exam using short sentences, multiple choices, true or false, matching and short answers if necessary.	❖ Use oral response as an option to give answer for trainees having severe upper limb impairment ❖ Time extension for trainees having severe upper limb impairment
Demonstration/Observation	❖ Brief the instruction or provide them in large text ❖ Time extension	❖ Use sign language interpreter ❖ Brief on the instruction of the exam ❖ Provide activity-based/ practical assessment method ❖ Time extension	❖ Provide activity based assessment ❖ Brief on the instruction of the exam ❖ Use loud voice ❖ Time extension	❖ Provide activity based assessment ❖ Conduct close follow up ❖ Time extension

ASSESSMENT CRITERIA:

LO1. Undertake mask and jig work

- Jigs are secured and masking is adherent and stable.
- Necessary auxiliary electrodes and shields are incorporated effectively.
- Necessary jigs and shields are manufactured.

LO 2.Determine operating parameters

- Plating knowledge and/or specifications are applied in correctly computing operating times, currents and/or voltages.
- Materials for coating are selected based on the type of material and standard.

LO 3.Pre-treat and treat work

- Machines for pre-treatment of work are selected based on the standard.
- Work is treated in accordance with specifications using standard operating procedures.

Annex: Resource Requirements

IND MCS4 M08 0322 Prepare and Produce Specialized Coatings				
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	Fundamentals of metallic corrosion Atmospheric and media corrosion of metals, by Philip A.Schweitzer,2006	5	1:5
3	Text books			
4.	Journals/Publication/Magazines			
B.	**Learning Facilities & Infrastructure**			
1.	Lecture Room	Standard		1:25
2.	Library	Standard		1:25
3.	Laboratory	Standard		1:25
C.	**Consumable Materials**			
1.	• Soluble auxiliary anodes • Insoluble auxiliary anodes • Bi polar electrodes • Shields		As requied	1:1
D.	**Tools and Equipments**			
1.	Hand and power tools,	STD	As required	1:5
2.	Measuring tools,	STD	5each	1:5
3.	Protective clothing and equipment	Pcs.	25	1:1

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.

The trainers who developed the curriculum

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