# MECHANIICS
# LEVEL – V



# 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 V**.**

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 V

## 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 Develop Proactive Maintenance Strategy, Plan and Calculate Basic Mechanical Systems Job, Determine Appropriate Measuring System for Specific Process, Develop and Document Technical Specifications and Procedures, Facilitate the Development of New Product, Analyze and Perform Control Requirements Solutions, Develop value chain analysis 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 MCS5 01 1221** Develop Proactive Maintenance Strategy

**IND MCS5 02 1221** Plan and Calculate Basic Mechanical Systems Job

**IND MCS5 03 1221** Determine Appropriate Measuring System for Specific Process

**IND MCS5 04 1221** Develop and Document Technical Specifications and Procedures

**IND MCS5 05 1221** Facilitate the Development of New Product

**IND MCS5 06 1221** Analyze and Perform Control Requirements Solutions

**IND MCS5 07 1221** Develop value chain analysis

### 1.4. Duration of the TVET-Program

The Program will have duration of ***370-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. | Develop Proactive Maintenance Strategy | 20 | 20 | 10 | 50 | |
| 2. | Plan and Calculate Basic Mechanical Systems Job, | 30 | 20 | 20 | 70 | |
| 3. | Determine Appropriate Measuring System for Specific Process, | 20 | 30 | 20 | 70 | |
| 4. | Develop and Document Technical Specifications and Procedures, | 30 | 20 | 10 | 60 | |
| 5. | Facilitate the Development of New Product, | 30 | 20 | 10 | 60 | |
| 6. | Analyze and Perform Control Requirements Solutions, | 20 | 30 | 20 | 70 | |
| 7. | Develop value chain analysis | 30 | 30 | 10 | 70 | |
| **Total Hrs.** | | 180 | 170 | 100 | 450 | |

### 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 V**.**

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 MCS5 01 1221** | Develop Proactive Maintenance Strategy | **IND MCS5 M01 0322** | Developing Proactive Maintenance Strategy | • Determine appropriate analytical techniques<br>• Develop reliability strategies<br>• Implement strategies<br>• Monitor the implementation of strategy | 50 |
| **IND MCS5 02 1221** | Plan and Calculate Basic Mechanical Systems Job, | **IND MCS5 M02 0322** | Planning and Calculating Basic Mechanical Systems Job, | • Research equipment function and operational requirements<br>• Calculate construction and processing data<br>• Prepare a preliminary sketch/drawing/ specifications<br>• Plan the mechanical system | 70 |
| **IND MCS5 03 1221** | Determine Appropriate Measuring System for Specific Process, | **IND MCS5 M03 0322** | Determining Appropriating Measuring System for Specific Process, | • Check equipment for correct operation<br>• Validate/Calibrate precision measuring equipment<br>• Monitor and manage on-going technical processes/ operations<br>• Develop work programs and schedules and tax the costs of precision<br>• Monitor the condition of plant and resourc<br>• Plan corrective action as required to improve specific parts of the process<br>• Monitor environmental performance | 70 |
| **IND MCS5 04 1221** | Develop and Document Technical Specifications and Procedures, | **IND MCS5 M04 0322** | Developing and Documenting Technical Specifications and Procedures, | • Identify requirements<br>• Prepare specifications<br>• Facilitate process problem resolution and Prepare technical procedures<br>• Monitor process improvements and | 60 |

| | | | | | |
|---|---|---|---|---|---|
| | | | | variations | |
| **IND MCS5 05 1221** | Facilitate the Development of New Product, | **IND MCS5 M05 0322** | Facilitating the Development of New Product, | • Confirm design brief of new product in consultation with relevant people<br>• Determine material requirements for produc<br>• Determine process requirements for produc<br>• Monitor process needs for the new product<br>• Trial new product through the process<br>• Determine process capability<br>• Coordinate product trials<br>• Implement standard procedures for new product | 60 |
| **IND MCS5 06 1221** | Analyze and Perform Control Requirements Solutions, | **IND MCS5 M06 0322** | Analyzing and Performing Control Requirements Solutions, | • Determine system requirements<br>• Analyze control requirements<br>• Select control system components<br>• Solve control requirements<br>• Verify component selection | 70 |
| **IND MCS5 07 1221** | Develop value chain analysis | **IND MCS5 M07 0322** | Developing value chain analysis | • Evaluate the value chain<br>• Develop value chain<br>• Apply technology to assist in solving organizational problem.<br>• Evaluate new or upgraded technology performance | 70 |
| | | | | | 450 |

*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 V**

MODULE TITLE: **Developing Proactive Maintenance Strategy**

MODULE CODE: **IND MCS5 M01 0322**

NOMINAL DURATION**:** **50 Hours**

**MODULE DESCRIPTION**: This module covers the skills, knowledge and attitudes required to develop and implement a proactive maintenance strategy for an organization. The unit recognizes that there are a number of predictive or proactive maintenance strategies, such as Total Productive Maintenance (TPM) and Reliability Centered Maintenance (RCM).

**LEARNING OUTCOMES**

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

**LO1.** Determine appropriate analytical techniques
**LO2.** Develop reliability strategies
**LO3.** Implement strategies
**LO4**: Monitor the implementation of strategy

**MODULE CONTENTS:**

**LO1.** Determine appropriate analytical techniques

1.1. Liaising key stakeholders.
1.2. Examining current maintenance situation.
1.3. Comparing possible strategies, techniques and tools.
1.4. Selecting possible strategies, techniques and tools.
1.5. Confirming selected strategies, techniques and tools.

**LO2.** Develop reliability strategies

2.1. Selecting preferred maintenance strategy.
2.2. Examining and adapting strategy.
2.3. Examining and adapting techniques and tools
2.4. Identifying key information and performance indicators required

**LO3.** Implement strategies

3.1. Identifying data collection required
3.2. Identifying hardware and other resources required
3.3. Identifying skill needs required in consultation with key stakeholders
3.4. Ensuring all resources/training to implement strategy available

**LO4**: Monitor the implementation of strategy

4.1. Comparing information/performance indicators with desired levels
4.2. Liaising key stakeholders with regarding strategy issues
4.3. Identifying areas requiring adjustment
4.4. making required adjustments

| **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<br>❖ Prepare the lecture in **Audio/video**<br>❖ Organize the class room seating arrangement to be accessible to trainees<br>❖ Write short notes on the black/white board using large text<br>❖ Make sure the luminosity of the light of class room is kept<br>❖ Use normal tone of voice<br>❖ Encourage trainees to record the lecture in audio format<br>❖ Provide Orientation on the physical feature of the work shop<br>❖ Summarize main points | ❖ Assign sign language interpreter<br>❖ Arrange the class room seating to be conducive for eye to eye contact<br>❖ Make sure the luminosity of the light of class room is kept<br>❖ Introduce new and relevant vocabularies<br>❖ Use short and clear sentences<br>❖ Give emphasis on visual lecture and ensure the attention of the trainees<br>❖ Avoid movement during lecture time<br>❖ Present the lecture in video format<br>❖ Summarize main points | ❖ Organize the class room seating arrangement to be accessible to trainees<br>❖ Speak loudly<br>❖ Ensure the attention of the trainees<br>❖ Present the lecture in video format<br>❖ Ensure the attention of the trainees | ❖ Organize the class room seating arrangement to be accessible for wheelchairs users.<br>❖ Facilitate and support the trainees who have severe impairments on their upper limbs to take note<br>❖ Provide Orientation on the physical feature of the work shop |
| **Demonstration** | ❖ Conduct close follow up<br>❖ Use verbal description<br>❖ Provide special attention in the process of guidance<br>❖ facilitate the support of peer trainees<br>❖ Prepare & use simulation | ❖ use Sign language interpreter<br>❖ Use video recorded material<br>❖ Ensure attention of the trainees<br>❖ Provide structured training<br>❖ Show clear and short method<br>❖ Use gesture<br>❖ | ❖ Illustrate in clear & short method<br>❖ Use Video recorded material<br>❖ Ensure the attention of the trainees<br>❖ | ❖ Facilitate and support the trainees having severe upper limbs impairment to operate equipments/ machines<br>❖ Assign peer trainees to assist<br>❖ Conduct close follow up<br>❖ |

| | | | | |
|---|---|---|---|---|
| | | rovide tutorial support (if necessary) | rovide tutorial support (if necessary) | rovide tutorial support (if necessary |
| **Group discussion** | ❖ Facilitate the integration of trainees with group members<br>❖ Conduct close follow up<br>❖ Introduce the trainees with other group member<br>❖ Brief the thematic issues of the work | ❖ Use sign language interpreters<br>❖ Facilitate the integration of trainees with group members<br>❖ Conduct close follow up<br>❖ Introduce the trainees with other group member | ❖ Facilitate the integration of trainees with group members<br>❖ Conduct close follow up<br>❖ Introduce the trainees with other group member<br>❖ Inform the group members to speak loudly | ❖ Introduce the trainees with their peers |
| **Exercise** | ❖ Conduct close follow up and guidance<br>❖ Provide tutorial support if necessary<br>❖ provide special attention in the process | ❖ Conduct close follow up and guidance<br>❖ Provide tutorial support if necessary<br>❖ provide special attention in the process/practical training<br>❖ Introduce new and relevant vocabularies | ❖ Conduct close follow up and guidance<br>❖ Provide tutorial support if necessary<br>❖ provide special attention in the process/ practical training | ❖ Assign peer trainees<br>❖ Use additional nominal hours if necessary |

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|---|---|---|---|---|
| **Individual assignment** | ❖ prepare the assignment questions in large text<br>❖ Encourage the trainees to prepare and submit the assignment in large texts<br>❖ Make available recorded assignment questions<br>❖ Facilitate the trainees to prepare and submit the assignment in soft or hard copy | ❖ Use sign language interpreter<br>❖ Provide briefing /orientation on the assignment<br>❖ Provide visual recorded material | ❖ Provide briefing /orientation on the assignment<br>❖ Provide visual recorded material | |

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

**ASSESSMENT CRITERIA:**

**LO1.** Determine appropriate analytical techniques

- Key stakeholders are liaised with to determine objectives of maintenance strategy
- Current maintenance situation is examined to determine major areas requiring improvement
- Possible strategies, techniques and tools are compared against organisation needs
- Possible strategies, techniques and tools are selected
- Selected strategies, techniques and tools are confirmed with key stakeholders

**LO2.** Develop reliability strategies

- Preferred maintenance strategy is selected
- Strategy is examined and adapted to organisation needs and priorities
- Techniques and tools required to implement strategy are examined and adapted
- Key stakeholders are liaised with to develop an implementation plan
- Key information and performance indicators required are identified

**LO3.** Implement strategies

- Data collection required is identified
- Hardware and other resources required are identified
- Skill needs required are identified in consultation with key stakeholders
- All resources/training are ensured to implement strategy available

**LO4**: Monitor the implementation of strategy

- Information/performance indicators are compared with desired levels
- Key stakeholders are liaised with regarding strategy issues
- Areas requiring adjustment are identified
- Required adjustments are made

**Annex: Resource Requirements**

| IND MCS5 M01 0322 : Developing Proactive Maintenance Strategy | | | | |
|---|---|---|---|---|
| Item No. | Category/Item | Description/ Specifications | Quantity (pc./participant) | Recommended Ratio (Item: Trainee) |
| A. | Learning Materials | | | |
| 1 | TTLM | Prepared by trainer | 25 | 1:1 |
| 2 | Textbook | -Proactive Maintenance for Mechanical Systems 1st Edition - October 30, 1992 | 5 | 1:5 |
| 3 | Reference book | | 5 | 1:5 |
| | Journals/publications/magazines | Recent | 5 | 1:5 |
| B. | Learning Facilities & Infrastructure | | | |
| 1 | Lecture room | Standard | 1 | 1:25 |
| C. | Consumable Materials | | | |
| 1 | Oil wipers, grease containers, tool tips, indicator globes, fluids and lubricants, guides and limit switch actuators etc | STD | As required | 1:5 |
| D. | Tools and Equipment's | | | |
| 1 | Hand and power tools, | STD | 5 | 1:5 |
| 2 | Measuring tools, | STD | As required | 1:5 |
| 3. | Protective clothing and equipment | STD | 25 | 1:1 |

| LEARNING MODULE 02 |
|---|
| TVET-PROGRAMME TITLE: **Mechanics Level V** |
| MODULE TITLE: **Planning and Calculating Basic Mechanical Systems Job** |
| MODULE CODE: **IND MCS5 M02 0322** |
| NOMINAL DURATION: **70 Hours** |
| **MODULE DESCRIPTION**: This module covers the knowledge, skills and attitudes in planning and calculating basic mechanical system job, and selecting the components and mechanical features required in performing simple functions. |

**LEARNING OUTCOMES**

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

**LO1.** Research equipment function and operational requirements

**LO2.** Calculate construction and processing data

**LO3.** Prepare a preliminary sketch/drawing/ specifications

**LO4**: Plan the mechanical system

**MODULE CONTENTS:**

**LO1.** Research equipment function and operational requirements

1.1. Obtaining all relevant drawings, specifications, manuals and documentation.
1.2. Consulting appropriate personnel.
1.3. Interpreting information collected and prepared.
1.4. Verifying draft functional and operational requirements.

**LO2.** Calculate construction and processing data

2.1. Collecting and calculating all relevant data for the process.
2.2. Translating data for use in sketch/drawing and specifications

**LO3.** Prepare a preliminary sketch/drawing/ specifications

3.1. Selecting appropriate basic components, assemblies and fasteners.
3.2. Selecting where required components and/or materials.
3.3. Applying appropriate and relevant codes to the sketch/drawing/specification.
3.4. Approving the preliminary sketch/drawing/specification.

**LO4**: Plan the mechanical system

4.1. Identifying parts of the mechanical system.
4.2. Composing the parts to a mechanical system.
4.3. Making necessary programming of NC and CNC machines.
4.4. Simulating and evaluating the function.

| **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<br>❖ Prepare the lecture in **Audio/video**<br>❖ Organize the class room seating arrangement to be accessible to trainees<br>❖ Write short notes on the black/white board using large text<br>❖ Make sure the luminosity of the light of class room is kept<br>❖ Use normal tone of voice<br>❖ Encourage trainees to record the lecture in audio format<br>❖ Provide Orientation on the physical feature of the work shop<br>❖ Summarize main points | ❖ Assign sign language interpreter<br>❖ Arrange the class room seating to be conducive for eye to eye contact<br>❖ Make sure the luminosity of the light of class room is kept<br>❖ Introduce new and relevant vocabularies<br>❖ Use short and clear sentences<br>❖ Give emphasis on visual lecture and ensure the attention of the trainees<br>❖ Avoid movement during lecture time<br>❖ Present the lecture in video format<br>❖ Summarize main points | ❖ Organize the class room seating arrangement to be accessible to trainees<br>❖ Speak loudly<br>❖ Ensure the attention of the trainees<br>❖ Present the lecture in video format<br>❖ Ensure the attention of the trainees | ❖ Organize the class room seating arrangement to be accessible for wheelchairs users.<br>❖ Facilitate and support the trainees who have severe impairments on their upper limbs to take note<br>❖ Provide Orientation on the physical feature of the work shop |
| **Demonstration** | ❖ Conduct close follow up<br>❖ Use verbal description<br>❖ Provide special attention in the process of guidance<br>❖ facilitate the support of peer trainees<br>❖ Prepare & use simulation | ❖ use Sign language interpreter<br>❖ Use video recorded material<br>❖ Ensure attention of the trainees<br>❖ Provide structured training<br>❖ Show clear and short method<br>❖ Use gesture<br>❖ rovide tutorial support (if necessary) | ❖ Illustrate in clear & short method<br>❖ Use Video recorded material<br>❖ Ensure the attention of the trainees<br>❖ rovide tutorial support (if necessary | ❖ Facilitate and support the trainees having severe upper limbs impairment to operate equipments/ machines<br>❖ Assign peer trainees to assist<br>❖ Conduct close follow up<br>❖ rovide tutorial support (if necessary |
| **Group discussion** | ❖ Facilitate the integration of trainees with group members<br>❖ Conduct close follow up<br>❖ Introduce the trainees with other group member | ❖ Use sign language interpreters<br>❖ Facilitate the integration of trainees with group members<br>❖ Conduct close follow up<br>❖ Introduce the trainees with other | ❖ Facilitate the integration of trainees with group members<br>❖ Conduct close follow up | ❖ Introduce the trainees with their peers |

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

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

**ASSESSMENT CRITERIA:**

**LO1.** Research equipment function and operational requirements

- All relevant drawings, specifications, manuals and documentation are obtained in accordance with workplace procedures.
- Appropriate personnel are consulted to determine requirements.
- Information collected is interpreted and draft functional and operational requirements are prepared and verified with supervisor or design team.

**LO2.** Calculate construction and processing data

- All relevant data for the process are collected and calculated.
- Data is translated for use in sketch/drawing and specifications

**LO3.** Prepare a preliminary sketch/drawing/ specifications

- Appropriate ***basic components, assemblies and fasteners*** are selected to perform the required function.
- Where required, components and/or materials are selected from supplier/manufacturer catalogues.
- Appropriate and relevant codes are applied to the sketch/drawing/specification in accordance with workplace procedures.
- The preliminary sketch/drawing/specification is approved in accordance with policy and procedures.

**LO4**: Plan the mechanical system

- Parts of the mechanical system are identified, according to the sketch and the collected data
- The parts are composed to a mechanical system.
- Necessary programming of NC and CNC machines are made
- The function will be simulated and evaluated where possible optimizations will be done

**Annex: Resource Requirements**

| IND MCS5 M02 0322<br><br>Planning and Calculating Basic Mechanical Systems Job | | | | |
|---|---|---|---|---|
| Item No. | Category/Item | Description/ Specifications | Quantity (pc./participant) | Recommended Ratio (Item: Trainee) |
| A. | Learning Materials | | | |
| 1 | TTLM | Prepared by trainer | 25 | 1:1 |
| 2 | Textbook | - | | |
| 3 | Reference book | -Handbook of Mechanical Engineering Calculations, 2nd Edition<br>Tyler G. Hicks 2006<br>M.P. Groover, (2001)"Automation, Production Systems, and Computer<br>T.C. Chang, R.A. Wysk, (1985) "An Introduction to Automated Process Planning Systems", Prentice | 5 | 1:5 |
| 4 | Journals/publications/magazines | Recent | | |
| B. | Learning Facilities & Infrastructure | | | |
| 1 | Lecture room | Standard | 1 | 1:25 |
| C. | Consumable Materials | | | |
| 1 | Copy paper | A4 size | 1rim | 1:25 |
| D. | Tools and Equipment’s | | | |
| 1 | Computers | | 25 | 1:1 |
| 2 | Tools: Venier Caliper, Micrometer, CNC Machine Tools, Accessories, etc. | | 5 | 1:5 |
| 3 | Equipment: CNC Lathe Machines, Power Hack Saw, etc | | 5 | 1:5 |

| LEARNING MODULE 03 |
|---|
| TVET-PROGRAMME TITLE: **Mechanics Level V** |
| MODULE TITLE: **Determining Appropriate Measuring System for Specific Process** |
| **MODULE CODE: IND MCS5 M03 0322** |
| NOMINAL DURATION: . **70 Hours** |
| **MODULE DESCRIPTION**: This module covers the knowledge, skills and attitudes in managing a number of processes to ensure adequate resources, programming and maintenance for operations. This module includes checking measuring equipment for correct operation, and validating/calibrating precision measuring equipment in accordance with predetermined procedures. |
| **LEARNING OUTCOMES**<br>At the end of the module the trainee will be able to:<br>**LO1.** Check equipment for correct operation<br>**LO2.**Validate/Calibrate precision measuring equipment<br>**LO3**. Monitor and manage on-going technical processes/ operations<br>**LO4.** Develop work programs and schedules and tax the costs of precision<br>**LO5.** Monitor the condition of plant and resources<br>**LO6.** Plan corrective action as required to improve specific parts of the process<br>**LO7**. Monitor environmental performance |
| **MODULE CONTENTS:**<br>**LO1.** Check equipment for correct operation<br>1.1 Making appropriate checks of components, for wear, loose connections or other faults.<br>1.2 Making appropriate checks for integrated operations of equipment.<br>**LO2.** Validate/Calibrate precision measuring equipment<br>2.1 Assessing calibration of precision measuring equipment<br>2.2 Calibrating equipment<br>2.3 Using correct calibration devices, equipment, techniques<br>2.4 Re-commissioning equipment<br>**LO3**. Monitor and manage on-going technical processes/ operations<br>3.1 Monitoring and analyzing a range of on-going technical processes/operations<br>3.2 Determining required measuring equipment and measuring process.<br>3.3 Documenting on-going technical processes |

**LO4.** Develop work programs and schedules and tax the costs of precision

4.1 Identifying required human resources and physical resources
4.2 Scheduling maintenance and system review activities
4.3 Scheduling purchasing and renewal requirements
4.4 Taxing costs of increasing precision
4.5 Setting precision

**LO5.** Monitor the condition of plant and resources

5.1 Monitoring and documenting condition of plant and resources
5.2 Diagnosing performance problems
5.3 Developing an energy and resource minimization plan

**LO6.** Plan corrective action as required to improve specific parts of the process

6.1 Identifying critical areas for performance improvement
6.2 Altering the process/system to control variation
6.3 Rectifying faults
6.4 Seeking feedback on the effectiveness of the process improvements
6.5 Documenting changes/alterations on the process.
6.6 Communicating customers/stakeholders

**LO7**. Monitor environmental performance

7.1 Conducting regular environmental audits of processes and systems
7.2 Analyzing and communicating result of environmental audits to stakeholders.

| **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<br>❖ Prepare the lecture in **Audio/video**<br>❖ Organize the class room seating arrangement to be accessible to trainees<br>❖ Write short notes on the black/white board using large text<br>❖ Make sure the luminosity of the light of class room is kept<br>❖ Use normal tone of voice<br>❖ Encourage trainees to record the lecture in audio format<br>❖ Provide Orientation on the physical feature of the work shop<br>❖ Summarize main points | ❖ Assign sign language interpreter<br>❖ Arrange the class room seating to be conducive for eye to eye contact<br>❖ Make sure the luminosity of the light of class room is kept<br>❖ Introduce new and relevant vocabularies<br>❖ Use short and clear sentences<br>❖ Give emphasis on visual lecture and ensure the attention of the trainees<br>❖ Avoid movement during lecture time<br>❖ Present the lecture in video format<br>❖ Summarize main points | ❖ Organize the class room seating arrangement to be accessible to trainees<br>❖ Speak loudly<br>❖ Ensure the attention of the trainees<br>❖ Present the lecture in video format<br>❖ Ensure the attention of the trainees | ❖ Organize the class room seating arrangement to be accessible for wheelchairs users.<br>❖ Facilitate and support the trainees who have severe impairments on their upper limbs to take note<br>❖ Provide Orientation on the physical feature of the work shop |
| **Demonstration** | ❖ Conduct close follow up<br>❖ Use verbal description<br>❖ Provide special attention in the process of guidance<br>❖ facilitate the support of peer trainees<br>❖ Prepare & use simulation | ❖ use Sign language interpreter<br>❖ Use video recorded material<br>❖ Ensure attention of the trainees<br>❖ Provide structured training<br>❖ Show clear and short method<br>❖ Use gesture<br>❖ rovide tutorial support (if necessary) | ❖ Illustrate in clear & short method<br>❖ Use Video recorded material<br>❖ Ensure the attention of the trainees<br>❖ rovide tutorial support (if necessary) | ❖ Facilitate and support the trainees having severe upper limbs impairment to operate equipments/ machines<br>❖ Assign peer trainees to assist<br>❖ Conduct close follow up<br>❖ rovide tutorial support (if necessary |
| **Group discussion** | ❖ Facilitate the integration of trainees with group members<br>❖ Conduct close follow up<br>❖ Introduce the trainees with other group member<br>❖ Brief the thematic issues of the work | ❖ Use sign language interpreters<br>❖ Facilitate the integration of trainees with group members<br>❖ Conduct close follow up<br>❖ Introduce the trainees with other | ❖ Facilitate the integration of trainees with group members<br>❖ Conduct close follow up | ❖ Introduce the trainees with their peers |

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

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

**ASSESSMENT CRITERIA:**

**LO.1** Check equipment for correct operation..

- Appropriate checks are made of components, for wear, loose connections or other fault
- Appropriate checks are made for integrated operations of equipment.

**LO.2** Validate/Calibrate precision measuring equipment

- ***Calibration*** of precision measuring equipment is assessed based on manufacturers' specifications and/or standard operating procedures.
- Equipment is calibrated against appropriate ***physical standards*** using correct ***calibration devices***, ***equipment***, ***techniques*** and using predetermined procedures.
- Equipment is ***re-commissioned*** in accordance with standard operating procedures.

**LO.3** Monitor and manage on-going technical processes/ operations

- A range of on-going technical processes/operations and their related interaction are ***monitored*** and analyzed
- Required measuring equipment and measuring process are determined to ensure sufficient precision
- On-going technical processes are adequately documented

**LO.4** Develop work programs and schedules and tax the costs of precision

- Required ***human resources*** and physical resources are identified for the ongoing proce
- Maintenance and system review activities are scheduled
- Purchasing and renewal requirements are scheduled
- ***Costs*** of increasing precision are taxed
- Precision that most fits the economy as well as the quality is set

**LO5.** Monitor the condition of plant and resources

- Condition of plant and resources are monitored and documented according to the measured data
- Performance problems are diagnosed
- An energy and resource minimization plan is developed

LO6. Plan corrective action as required to improve specific parts of the process

- Critical areas are identified for performance improvement
- The process/system is altered to ensure that variation is controlled and faults are rectifi
- Feedback on the effectiveness of the process improvements is sought from concerned people
- Changes/alterations on the process are documented and communicated to customers/stakeholders.

LO7. Monitor environmental performance

- Regular environmental audits of processes and systems are conducted
- Result of environmental audits is analyzed and communicated to stakeholders.

**Annex: Resource Requirements**

| IND MCS5 M03 0322<br>Determining Appropriate Measuring System for Specific Process | | | | |
|---|---|---|---|---|
| **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 | Introduction to Instrumentation and Measurements Robert B Northrop, (2005).<br>Dybkaer R. Metrology in laboratory medicine – Reference measurement systems. Accred Qual Assur. 2001 | 5 | 1:5 |
| 3. | Journals/Publication/Magazines | | | |
| ***B.*** | ***Learning Facilities & Infrastructure*** | | | |
| 1. | Lecture Room | 6mx6m | 1 | 1:25 |
| 2. | Library | Standard | 1 | 1:25 |
| 3. | Laboratory | Standard | 1 | 1:25 |
| ***C.*** | ***Consumable Materials*** | | | |
| 1. | A4 Paper | Packet | 5 | 1:5 |
| 2 | Round Shafting Specimen of different material | Pcs | 25 | 1:1 |
| 5 | Square Bar Specimen of different material | Pcs | 25 | 1:1 |
| 6 | Sheet Metal Specimen of different material | Pcs | 25 | 1:1 |
| 6 | Bolt and Nuts | Pcs | 5 | 1:5 |
| ***D.*** | ***Tools and Equipments*** | | | |
| 1. | Steel rule | 30-50cm | 5 | 1:5 |
| 2 | Vernier Caliper | 0.02mm,0.05mm | 5 | 1:5 |

| | | | | |
|---|---|---|---|---|
| 3 | Combination Set | Standard | 5 | 1:5 |
| 4 | Dial Indicators | Standard | 5 | 1:5 |
| 5 | Computer | desktop | 25 | 1:1 |
| 6 | Projector | | 1 | |

| LEARNING MODULE 04 |
|---|
| TVET-PROGRAMME TITLE: Mechanics **Level V** |
| MODULE TITLE: **Developing and Documenting Technical Specifications and Procedures** |
| MODULE CODE: **IND MCS5 M04 0322** |
| NOMINAL DURATION: **60 Hours** |
| **MODULE DESCRIPTION**: This module covers the competence knowledge, skills and attitudes of managing technical processes in the preparation of resource and analyze requirements and to develop and document technical specifications and procedures providing concise and unambiguous direction and guidance for workplace activities. |
| **LEARNING OUTCOMES**<br>At the end of the module the trainee will be able to:<br>**LO1.** Identify requirements<br>**LO2.** Prepare specifications<br>**LO3**. Facilitate process problem resolution and Prepare technical procedures.<br>**LO4.** Monitor process improvements and variations. |
| **MODULE CONTENTS:**<br>**LO1.** Identify requirements<br>1.1. Interpret technical process requirements<br>1.2. Identifying and assembling schedules, technical resources and procedures<br>1.3. Establishing and confirming specifications and procedures requirements and format<br>1.4. Identifying requirements for information entry, storage, output and quality of document production.<br>1.5. Making Specifications and procedures document design<br>1.6. Making range of functions incorporated in the document design to reflect the nominated requirements.<br>**LO2.** Prepare specifications<br>2.1 Collecting monitoring and guidance technical information,<br>2.2 Testing and validating or confirming before use.<br>2.3 Monitoring process parameters.<br>2.4 Identifying authoritative sources and references.<br>2.5 Writing specifications in a format.<br>2.6 Making specification documentation to satisfy enterprise and industry standards<br>**LO3**. Facilitate process problem resolution and prepare technical procedures. |

3.1 Using systematic identification and of process problems
3.2 Facilitating implementation of the recommended problem resolution option.
3.3 Identifying, analyzing and documenting activities and tasks.
3.4 Sequencing logically grouped activities and tasks.
3.5 Documenting procedures.

**LO4.** Monitor process improvements and variations.

4.1 Monitoring improvements and variations to process to ensure
4.2 Collating and analyzed data to evaluate the effectiveness of process improvements or variations.

| **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<br>❖ Prepare the lecture in **Audio/video**<br>❖ Organize the class room seating arrangement to be accessible to trainees<br>❖ Write short notes on the black/white board using large text<br>❖ Make sure the luminosity of the light of class room is kept<br>❖ Use normal tone of voice<br>❖ Encourage trainees to record the lecture in audio format<br>❖ Provide Orientation on the physical feature of the work shop<br>❖ Summarize main points | ❖ Assign sign language interpreter<br>❖ Arrange the class room seating to be conducive for eye to eye contact<br>❖ Make sure the luminosity of the light of class room is kept<br>❖ Introduce new and relevant vocabularies<br>❖ Use short and clear sentences<br>❖ Give emphasis on visual lecture and ensure the attention of the trainees<br>❖ Avoid movement during lecture time<br>❖ Present the lecture in video format<br>❖ Summarize main points | ❖ Organize the class room seating arrangement to be accessible to trainees<br>❖ Speak loudly<br>❖ Ensure the attention of the trainees<br>❖ Present the lecture in video format<br>❖ Ensure the attention of the trainees | ❖ Organize the class room seating arrangement to be accessible for wheelchairs users.<br>❖ Facilitate and support the trainees who have severe impairments on their upper limbs to take note<br>❖ Provide Orientation on the physical feature of the work shop |
| **Demonstration** | ❖ Conduct close follow up<br>❖ Use verbal description<br>❖ Provide special attention in the process of guidance<br>❖ facilitate the support of peer trainees<br>❖ Prepare & use simulation | ❖ use Sign language interpreter<br>❖ Use video recorded material<br>❖ Ensure attention of the trainees<br>❖ Provide structured training<br>❖ Show clear and short method<br>❖ Use gesture<br>❖ rovide tutorial support (if necessary) | ❖ Illustrate in clear & short method<br>❖ Use Video recorded material<br>❖ Ensure the attention of the trainees<br>❖ rovide tutorial support (if necessary) | ❖ Facilitate and support the trainees having severe upper limbs impairment to operate equipments/ machines<br>❖ Assign peer trainees to assist<br>❖ Conduct close follow up<br>❖ rovide tutorial support (if necessary |
| **Group discussion** | ❖ Facilitate the integration of trainees with group members<br>❖ Conduct close follow up<br>❖ Introduce the trainees with other group member<br>❖ Brief the thematic issues of the work | ❖ Use sign language interpreters<br>❖ Facilitate the integration of trainees with group members<br>❖ Conduct close follow up<br>❖ Introduce the trainees with other group member | ❖ Facilitate the integration of trainees with group members<br>❖ Conduct close follow up<br>❖ Introduce the trainees with other group | ❖ Introduce the trainees with their peers |

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

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

**ASSESSMENT CRITERIA:**

**LO.1** Identify requirements

- Technical process requirements are interpreted in terms of resources and procedures
- Schedules, technical resources and procedures is identified and assembled
- ***Specifications and procedures*** requirements and formats are established and confirmed, where necessary
- Requirements for information entry, storage, output and quality of document production are identified in accordance with enterprise procedures
- Specifications and procedures document design are made appropriate for efficient entry of information and satisfy appearance and presentation requirements for the purpose of the document
- Range of functions incorporated in the document design are made to reflect the nominated requirements

**LO.2** Prepare specifications

- Technical information is collected, monitored and guidance provided, where required for use in the specification; tested and validated or confirmed before use
- Process parameters are monitored to ensure conformance to requirements
- Authoritative sources and references are identified and used in the preparation and presentation of the specification
- Specifications are written in a format to ensure requirements can be met
- Specifications are written in a manner that is clear and understood in the workplace
- Specification documentation is made to satisfy enterprise and industry standards

**LO.3** Facilitate process problem resolution and Prepare technical procedures.

- Knowledge of process improvement and technical systems are used to assist in the systematic identification and resolution of process problems
- Implementation of the recommended problem resolution option is facilitated
- Activities and tasks are identified, analyzed and documented
- Activities and tasks are sequenced and logically grouped
- Procedures are documented to enterprise and industry standards

LO4 Monitor process improvements and variations.

- Improvements and variations to process are monitored to ensure outcome meets specifications, production schedule and workplace requirements
- Data is collated and analyzed to evaluate the effectiveness of process improvements or variations

**Annex: Resource Requirements**

| **IND MCS5 M04 0322**<br>**Developing and Documenting Technical Specifications and Procedures** | | | | |
|---|---|---|---|---|
| **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 | -Technical Documentation and Process<br>*By*<br>*Jerry C. Whitaker*<br>*Robert K. Mancini*<br>2013 | 5 | 1:5 |
| 3. | Journals/Publication/Magazines | | | |
| ***B.*** | ***Learning Facilities & Infrastructure*** | | | |
| 1. | Lecture Room | Standard | 1 | 1:25 |
| 2. | Library | Standard | 1 | 1:25 |
| ***C.*** | ***Consumable Materials*** | | | |
| 1. | A4 Paper | Packet | 5 | 1:25 |
| 2 | | | | |
| ***D.*** | ***Tools and Equipments*** | | | |
| 1. | Computer | Pcs | 25 | 1:1 |
| 2 | Projector | Pcs | 1 | 1:25 |

## LEARNING MODULE 05

TVET-PROGRAMME TITLE: **Mechanics Level V**

MODULE TITLE: **Facilitating the Development of New Product**

MODULE CODE: **IND MCS5 M05 0322**

NOMINAL DURATION: **60 Hours**

**MODULE DESCRIPTION**: This module covers the knowledge, skills and attitudes required to develop a new/evolutionary product within an existing range of products and encompass design for manufacture and the facilitation of its initial production.

**LEARNING OUTCOMES**

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

**LO1.**Confirm design brief of new product in consultation with relevant people

**LO2.** Determine material requirements for product

**LO3.** Determine process requirements for product

**LO4**. Monitor process needs for the new product

**LO5.** Trial new product through the process

**LO6.** Determine process capability

**LO7.** Coordinate product trials

**LO8.** Implement standard procedures for new product

**MODULE CONTENTS:**

**LO1.**Confirm design brief of new product in consultation with relevant people

1.1. Communicating and agreeing upon market requirements.

1.2. Determining regulatory requirements for product.

1.3. Identifying possible tooling/process/equipment needs.

1.4. Developing design brief to meet needs.

1.5. Obtaining sign off' on total design brief.

**LO2.** Determine material requirements for product

2.1. Selecting appropriate materials in liaison.

2.2. Determining material/component testing and evaluation regime required.

2.3. Arranging testing and evaluation of trial materials/components.

2.4. Monitoring trial process of materials.

2.5. Interpreting material trial result.

2.6. Determining final materials/components specifications and details of value chain.

**LO3.** Determine process requirements for product

3.1. Selecting appropriate process to make product.

3.2. Determining any special process/equipment requirements

3.3. Communicating other concerns and/or training or other needs with production personnel

3.4. Adjusting the design as required.

**LO4**. Monitor process needs for the new product

4.1. Coordinating equipment design and other needs.

4.2. Interpreting hardware specifications.

4.3. Coordinating appropriate draft procedures for the new product.

4.4. Validating product cost and design.

**LO5.** Trial new product through the process

5.1. Designing trialing procedure.

5.2. Coordinating trialing of the new product.

5.3. Interpreting product trial process results to HSE requirements.

5.4. Tuning process to optimize production of new product.

**LO6.** Determine process capability

6.1. Plotting appropriate statistical process control charts.

6.2. Determining confidence limits.

6.3. Comparing confidence limits with product specification.

**LO7.** Coordinate product trials

7.1. Determining product testing and required evaluation regime.

7.2. Arranging testing and evaluation of trial product/prototype.

7.3. Interpreting product trial results and guiding product trial process.

7.4. Determining final product specification in liaison.

7.5. Carrying required changes out to materials, process and equipment.

**LO8.** Implement standard procedures for new product

8.1. Monitoring initial production.

8.2. Adjusting in liaison with appropriate team members, process, conditions and materials.

8.3. Updating process specifications.

8.4. Implementing standard operating procedures.

8.5. Updating equipment and other hardware records.

8.6. Preparing project records.

8.7. Archiving 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<br>❖ Prepare the lecture in **Audio/video**<br>❖ Organize the class room seating arrangement to be accessible to trainees<br>❖ Write short notes on the black/white board using large text<br>❖ Make sure the luminosity of the light of class room is kept<br>❖ Use normal tone of voice<br>❖ Encourage trainees to record the lecture in audio format<br>❖ Provide Orientation on the physical feature of the work shop<br>❖ Summarize main points | ❖ Assign sign language interpreter<br>❖ Arrange the class room seating to be conducive for eye to eye contact<br>❖ Make sure the luminosity of the light of class room is kept<br>❖ Introduce new and relevant vocabularies<br>❖ Use short and clear sentences<br>❖ Give emphasis on visual lecture and ensure the attention of the trainees<br>❖ Avoid movement during lecture time<br>❖ Present the lecture in video format<br>❖ Summarize main points | ❖ Organize the class room seating arrangement to be accessible to trainees<br>❖ Speak loudly<br>❖ Ensure the attention of the trainees<br>❖ Present the lecture in video format<br>❖ Ensure the attention of the trainees | ❖ Organize the class room seating arrangement to be accessible for wheelchairs users.<br>❖ Facilitate and support the trainees who have severe impairments on their upper limbs to take note<br>❖ Provide Orientation on the physical feature of the work shop |
| **Demonstration** | ❖ Conduct close follow up<br>❖ Use verbal description<br>❖ Provide special attention in the process of guidance<br>❖ facilitate the support of peer trainees<br>❖ Prepare & use simulation | ❖ use Sign language interpreter<br>❖ Use video recorded material<br>❖ Ensure attention of the trainees<br>❖ Provide structured training<br>❖ Show clear and short method<br>❖ Use gesture<br>❖ rovide tutorial support (if necessary) | ❖ Illustrate in clear & short method<br>❖ Use Video recorded material<br>❖ Ensure the attention of the trainees<br>❖ rovide tutorial support (if necessary) | ❖ Facilitate and support the trainees having severe upper limbs impairment to operate equipments/ machines<br>❖ Assign peer trainees to assist<br>❖ Conduct close follow up<br>❖ rovide tutorial support (if necessary |
| **Group discussion** | ❖ Facilitate the integration of trainees with group members<br>❖ Conduct close follow up<br>❖ Introduce the trainees with other group member<br>❖ Brief the thematic issues of the work | ❖ Use sign language interpreters<br>❖ Facilitate the integration of trainees with group members<br>❖ Conduct close follow up<br>❖ Introduce the trainees with other group member | ❖ Facilitate the integration of trainees with group members<br>❖ Conduct close follow up<br>❖ Introduce the trainees with other group member<br>❖ Inform the group | ❖ Introduce the trainees with their peers |

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

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

**ASSESSMENT CRITERIA:**

**LO1.**Confirm design brief of new product in consultation with relevant people

- Technical specification, aesthetic requirements, timelines, cost and other market requirements are communicated and agreed upon with customer and other key stakeholders.
- Regulatory/industry code/intellectual property requirements for product are determined.
- Possible tooling/process/equipment needs are identified.
- Design brief, including relevant drawings are developed to meet needs
- Sign off' on total design brief is obtained from all relevant persons

**LO2.** Determine material requirements for product

- Appropriate materials/combination of materials/ components are selected in liaison with key stakeholders
- Material/component testing and evaluation regime required to meet product end user requirements, including regulatory/industry code requirements are determined
- Testing and evaluation of trial materials/components are arranged
- Trial process of materials is monitored and material trial result interpreted
- Final materials/components specifications and details of value chain are determined

**LO3.** Determine process requirements for product

- Appropriate process is selected to make product in liaison with key stakeholders and based on ***relevant factors***
- Any special process/equipment requirements for this product is/are determined
- Other concerns and/or training or other needs are communicated with production personnel
- The design is adjusted as required to satisfy customer and production needs

**LO4**. Monitor process needs for the new product

- Equipment design and other needs are coordinated with procurement personnel
- Hardware specifications are interpreted to ensure they are appropriate for the job required
- Appropriate draft procedures for the new product are coordinated with process personnel to ensure its compliance with the job required.
- Product cost and design are validated to meet objectives

**LO5.** Trial new product through the process

- Trialing procedure is designed to deliver required information
- Trialing of the new product is coordinated with relevant stakeholders
- Product trial process results are interpreted to ensure product is Health Safety and Environment (HSE requirements) strictly observed
- Process is tuned to optimize production of new product

**LO6.** Determine process capability

- Appropriate statistical process control charts are plotted
- Confidence limits are determined
- Confidence limits are compared with product specification

**LO7.** Coordinate product trials

- Product testing and required evaluation regime are determined to meet end user requirements, including regulatory/industry code requirements
- Testing and evaluation of trial product/prototype are arranged
- Product trial results are interpreted and product trial process is guided
- Final product specification is determined in liaison with key stakeholders
- Required changes are carried out to materials, process and equipment

**LO8.** Implement standard procedures for new product

- Initial production is monitored and, in liaison with appropriate team members, process, conditions and materials are adjusted to ensure the product and process outcomes conform to requirements
- Process specifications are updated to ensure that optimized operation developed are reflected
- Standard operating procedures are implemented to ensure conformity for the new product
- Equipment and other hardware records are updated to ensure that additions/changes are reflected
- Project records are prepared to ensure that all required reports have been completed and submitted
- Records are archived according to company procedures

**Annex: Resource Requirements**

| IND MCS5 M05 0322<br>Facilitating the Development of New Product | | | | |
|---|---|---|---|---|
| Item No. | Category/Item | Description/ Specifications | Quantity (pc./participant) | Recommended Ratio (Item: Trainee) |
| A. | Learning Materials | | | |
| 1 | TTLM | Prepared by trainer | 25 | 1:1 |
| 2 | Textbook | - | | |
| 3 | Reference book | Developing New Products and Services G. Lawrence Sanders, State University of New York at Buffalo 2012 | 5 | 1:5 |
| | Journals/publications/magazines | | | |
| B. | Learning Facilities & Infrastructure | | | |
| 1 | Lecture room | Standard | 1 | 1:25 |
| C. | Consumable Materials | | | |
| 1 | Copy paper | A4 size | 1rim | 1:25 |
| **D.** | **Tools and Equipment's** | | | |
| 1 | LCD projector | | | |

| LEARNING MODULE 06 |
|---|
| TVET-PROGRAMME TITLE: **MECHANICS Level V** |
| MODULE TITLE: **Analyzing and Performing Control Requirements Solutions** |
| MODULE CODE: **IND MCS5 06 0322** |
| NOMINAL DURATION**: 70 Hours** |
| **MODULE DESCRIPTION**: This module covers the knowledge, skills and attitudes required for solution and operation of important requirements by controller. |
| **LEARNING OUTCOMES**<br>At the end of the module the trainee will be able to:<br>**LO1.** Determine system requirements<br>**LO2.** Analyze control requirements<br>**LO3.** Select control system components<br>**LO4:** Solve control requirements<br>**LO5:** Verify component selection |
| **MODULE CONTENTS**<br><br>**LO1. Determine system requirements.**<br>1.1. Obtaining, understanding and clarifying instructions.<br>1.2. Interpreting drawings.<br>**LO2. Analyze control requirements.**<br>2.1 Analyzing requirements.<br>2.2 Detecting basic parts of hydraulic, pneumatic and electric control system.<br>2.3 Using electro-pneumatic/hydraulic control systems.<br>**LO3. Select control system components.**<br>3. 1. Detecting suitable components and alternatives.<br>3. 2. Selecting components for Hydraulic, pneumatic and electric circuits.<br>3. 3. Modifying functions of the control systems.<br>**LO4. Solve control requirements.**<br>4.1 Using hardware programmed logic controller and PLC.<br>4.2 Integrating solutions to the working process.<br>**LO5. Verify component selection**.<br>5.1 Setting - up and operating circuits.<br>5.2 Analyzing operation and verifying outcomes. |

| **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<br>❖ Prepare the lecture in **Audio/video**<br>❖ Organize the class room seating arrangement to be accessible to trainees<br>❖ Write short notes on the black/white board using large text<br>❖ Make sure the luminosity of the light of class room is kept<br>❖ Use normal tone of voice<br>❖ Encourage trainees to record the lecture in audio format<br>❖ Provide Orientation on the physical feature of the work shop<br>❖ Summarize main points | ❖ Assign sign language interpreter<br>❖ Arrange the class room seating to be conducive for eye to eye contact<br>❖ Make sure the luminosity of the light of class room is kept<br>❖ Introduce new and relevant vocabularies<br>❖ Use short and clear sentences<br>❖ Give emphasis on visual lecture and ensure the attention of the trainees<br>❖ Avoid movement during lecture time<br>❖ Present the lecture in video format<br>❖ Summarize main points | ❖ Organize the class room seating arrangement to be accessible to trainees<br>❖ Speak loudly<br>❖ Ensure the attention of the trainees<br>❖ Present the lecture in video format<br>❖ Ensure the attention of the trainees | ❖ Organize the class room seating arrangement to be accessible for wheelchairs users.<br>❖ Facilitate and support the trainees who have severe impairments on their upper limbs to take note<br>❖ Provide Orientation on the physical feature of the work shop |
| **Demonstration** | ❖ Conduct close follow up<br>❖ Use verbal description<br>❖ Provide special attention in the process of guidance<br>❖ facilitate the support of peer trainees<br>❖ Prepare & use simulation | ❖ use Sign language interpreter<br>❖ Use video recorded material<br>❖ Ensure attention of the trainees<br>❖ Provide structured training<br>❖ Show clear and short method<br>❖ Use gesture<br>❖ rovide tutorial support (if necessary) | ❖ Illustrate in clear & short method<br>❖ Use Video recorded material<br>❖ Ensure the attention of the trainees<br>❖ rovide tutorial support (if necessary) | ❖ Facilitate and support the trainees having severe upper limbs impairment to operate equipments/ machines<br>❖ Assign peer trainees to assist<br>❖ Conduct close follow up<br>❖ rovide tutorial support (if necessary |
| **Group discussion** | ❖ Facilitate the integration of trainees with group members<br>❖ Conduct close follow up<br>❖ Introduce the trainees with other group member<br>❖ Brief the thematic issues of the work | ❖ Use sign language interpreters<br>❖ Facilitate the integration of trainees with group members<br>❖ Conduct close follow up<br>❖ Introduce the trainees with other group member | ❖ Facilitate the integration of trainees with group members<br>❖ Conduct close follow up<br>❖ Introduce the trainees with other group member<br>❖ Inform the group members to speak loudly | ❖ Introduce the trainees with their peers |

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

**ASSESSMENT METHODS:**

| | | | | |
|---|---|---|---|---|
| **Interview** | | ❖ Use sign language interpreter<br>❖ Ensure or conform whether the proper communication was conducted with the trainee through the service of the sign language interpreter<br>❖ Use short and clear questioning<br>❖ Time extension | ❖ Speak loudly<br>❖ 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<br>❖ Use interview as an option if necessary<br>❖ Prepare the exam in audio format<br>❖ Assign human reader<br>❖ (if necessary)<br>❖ Time extension | ❖ Prepare the exam using short sentences, multiple choices, True or False, matching and short answers<br>❖ Avoid essay writing<br>❖ 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<br>❖ Time extension for trainees having severe upper limb impairment |
| **Demonstration/Observation** | ❖ Brief the instruction or provide them in large text<br>❖ Time extension | ❖ Use sign language interpreter<br>❖ Brief on the instruction of the exam<br>❖ Provide activity-based/ practical assessment method<br>❖ Time extension | ❖ Provide activity based assessment<br>❖ Brief on the instruction of the exam<br>❖ Use loud voice<br>❖ Time extension | ❖ Provide activity based assessment<br>❖ Conduct close follow up<br>❖ Time extension |

**ASSESSMENT CRITERIA:**

**LO1. Determine system requirements.**

- Instructions regarding system requirements are obtained, understood and clarified as necessary.
- Available drawings are interpreted correctly using standard symbols.

**LO2. Analyze control requirements.**

- Requirements are analyzed based on demand
- Basic parts of hydraulic, pneumatic and electric control system are detected.
- Electro-pneumatic/hydraulic control systems are used as development of traditional one

**LO3. Select control system components.**

- Suitable components and alternatives are detected with different systems developed.
- Components are selected for ***hydraulic***, pneumatic and electric circuits
- Functions of the control systems are modified according to the requirements and ***safety procedures***.

**LO4. Solve control requirements.**

- Hardware programmed logic controller and ***PLC*** are used for solutions
- Solutions are integrated into the working process

**LO5. Verify component selection**.

- Circuits are set- up and operated on laboratory benches.
- Operation is analyzed and outcomes are verified against system requirements.

**Annex: Resource requirements**

| IND MCS5 M06 0322<br>Analyzing and Performing Control Requirements Solutions | | | | |
|---|---|---|---|---|
| Item No. | Category/Item | Description/ Specifications | Quantity | Recommended Ratio (Item: Learner) |
| A. | Learning Materials | | | |
| 1. | TTLM | Prepared by trainer | 25 | 1:5 |
| 2. | Textbooks | | | |
| 3. | Reference Books | Fluid Power Edited by Mary Gannon and Richard Schneider, Hydraulics & Pneumatics magazine. 2018 | 5 | 1:5 |
| 4. | Journals/Publication/Magazines | | | |
| B. | Learning Facilities & Infrastructure | | | |
| 1. | Lecture Room | 5*5m | 1 | 1:25 |
| 2. | Library | | | |
| 3. | (etc.) | | | |
| C. | Consumable Materials | | | |
| 1. | paper | A4 | 5rim | 1:5 |
| 2. | Materials: Fluid (air, oil) | | | |
| D. | Tools and Equipments | | | |
| 1. | Tools: Hydraulic and pneumatic valves, connecting houses and actuators. | | | |
| 2. | Equipment: Compressor, pump, hydraulic motor, | | 5 | 1:5 |
| 3. | | | | |

| LEARNING MODULE 07 |
|---|
| TVET-PROGRAMME TITLE: **Mechanics Level V** |
| MODULE TITLE: **Developing value chain analysis** |
| MODULE CODE: **IND MCS5 M07 0322** |
| NOMINAL DURATION: **70 Hours** |
| **MODULE DESCRIPTION**: This module covers the knowledge, skills, and attitude needed to analyze value chain. This includes evaluate value chain, develop value chain, Apply technology to assist in solving organizational problem and evaluate new or upgraded technology performance. |

**LEARNING OUTCOMES**

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

**LO1.**Evaluate the value chain
**LO2.** Develop value chain
**LO3.** Apply technology to assist in solving organizational problem.
**LO4**. Evaluate new or upgraded technology performance

**MODULE CONTENTS:**

**LO1.**Evaluate the value chain
1.1 Identifying all members in the value chain.
1.2 Establishing and maintaining regular liaison.
1.3 Identifying current and forecast issues.
1.4 Identifying process required for a value chain analysis.
1.5 Identifying acute and chronic issues which impact on the value chain.

**LO2.** Develop value chain
2.1 Analyzing and identifying the existing and bench mark.
2.2 Identifying the gaps between AS IS compared to benchmark (TOBE)
2.3 Collecting and ranking analysis of technology constraints and gaps.
2.4 Identifying categorized technology

**LO3.** Apply technology to assist in solving organizational problem.
3.1 is applying new or upgraded technology.
3.2 Using features and functions of new or upgraded equipment.
3.3 Accessing and using sources of information relating to new or upgraded equipment.

**LO4**. Evaluate new or upgraded technology performance
4.1 Identifying changes in value added by each chain member.
4.2 Evaluating new or upgraded technology.
4.3 Determining environmental considerations from new or upgraded equipment.
4.4 Seeking feedback from users where appropriate.

| **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<br>❖ Prepare the lecture in **Audio/video**<br>❖ Organize the class room seating arrangement to be accessible to trainees<br>❖ Write short notes on the black/white board using large text<br>❖ Make sure the luminosity of the light of class room is kept<br>❖ Use normal tone of voice<br>❖ Encourage trainees to record the lecture in audio format<br>❖ Provide Orientation on the physical feature of the work shop<br>❖ Summarize main points | ❖ Assign sign language interpreter<br>❖ Arrange the class room seating to be conducive for eye to eye contact<br>❖ Make sure the luminosity of the light of class room is kept<br>❖ Introduce new and relevant vocabularies<br>❖ Use short and clear sentences<br>❖ Give emphasis on visual lecture and ensure the attention of the trainees<br>❖ Avoid movement during lecture time<br>❖ Present the lecture in video format<br>❖ Summarize main points | ❖ Organize the class room seating arrangement to be accessible to trainees<br>❖ Speak loudly<br>❖ Ensure the attention of the trainees<br>❖ Present the lecture in video format<br>❖ Ensure the attention of the trainees | ❖ Organize the class room seating arrangement to be accessible for wheelchairs users.<br>❖ Facilitate and support the trainees who have severe impairments on their upper limbs to take note<br>❖ Provide Orientation on the physical feature of the work shop |
| **Demonstration** | ❖ Conduct close follow up<br>❖ Use verbal description<br>❖ Provide special attention in the process of guidance<br>❖ facilitate the support of peer trainees<br>❖ Prepare & use simulation | ❖ use Sign language interpreter<br>❖ Use video recorded material<br>❖ Ensure attention of the trainees<br>❖ Provide structured training<br>❖ Show clear and short method<br>❖ Use gesture<br>❖ rovide tutorial support (if necessary) | ❖ Illustrate in clear & short method<br>❖ Use Video recorded material<br>❖ Ensure the attention of the trainees<br>❖ rovide tutorial support (if necessary) | ❖ Facilitate and support the trainees having severe upper limbs impairment to operate equipments/ machines<br>❖ Assign peer trainees to assist<br>❖ Conduct close follow up<br>❖ rovide tutorial support (if necessary |
| **Group discussion** | ❖ Facilitate the integration of trainees with group members<br>❖ Conduct close follow up<br>❖ Introduce the trainees with other group member<br>❖ Brief the thematic issues of the work | ❖ Use sign language interpreters<br>❖ Facilitate the integration of trainees with group members<br>❖ Conduct close follow up<br>❖ Introduce the trainees with other group member | ❖ Facilitate the integration of trainees with group members<br>❖ Conduct close follow up<br>❖ Introduce the trainees with other group member | ❖ Introduce the trainees with their peers |

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

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

**ASSESSMENT CRITERIA:**

**LO1.** Determine appropriate analytical techniques

- Key stakeholders are liaised with to determine objectives of maintenance strategy
- Current maintenance situation is examined to determine major areas requiring improvement
- Possible strategies, techniques and tools are compared against organisation needs
- Possible strategies, techniques and tools are selected
- Selected strategies, techniques and tools are confirmed with key stakeholders

**LO2.** Develop reliability strategies

- Preferred maintenance strategy is selected
- Strategy is examined and adapted to organization needs and priorities
- Techniques and tools required to implement strategy are examined and adapted
- Key stakeholders are liaised with to develop an implementation plan
- Key information and performance indicators required are identified

**LO3.** Implement strategies

- Data collection required is identified
- Hardware and other resources required are identified
- Skill needs required are identified in consultation with key stakeholders
- All resources/training are ensured to implement strategy available

**LO4**: Monitor the implementation of strategy

- Information/performance indicators are compared with desired levels
- Key stakeholders are liaised with regarding strategy issues
- Areas requiring adjustment are identified
- Required adjustments are made

**Annex: Resource Requirements**

| **IND MCS5 M07 0322 Developing value chain analysis** | | | | |
|---|---|---|---|---|
| Item No. | Category/Item | Description/ Specifications | Quantity (pc./participant) | Recommended Ratio (Item: Trainee) |
| A. | Learning Materials | | | |
| 1 | TTLM | Prepared by trainer | 25 | 1:1 |
| 2 | Textbook | | | |
| 3 | Reference book | A guide to value chain analysis and development December 2015 | 5 | 1:5 |
| | Journals/publications/magazines | | | |
| B. | Learning Facilities & Infrastructure | | | |
| 1 | Lecture room | Standard | 1 | 1:25 |
| C. | Consumable Materials | | | |
| 1 | Copy paper | A4 size | 1rim | 1:25 |
| D. | Tools and Equipment's | | | |
| 1 | LCD projector | | | |

**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**

| No | Name | Qualification | Educational background | Region | College | Mobile number | E-mail |
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