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MINISTRY OF LABOR AND SKILLS

ELECTRICAL/ELECTRONICS EQUIPMENT SERVICING LEVEL – III



CURRICULUM

Based on (October, 2021V1) 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 **ELECTRICAL/ELECTRONICS EQUIPMENT SERVICING Level III.**

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

TVET-Program Design

TVET-Program Title: Electrical/Electronic Equipment Servicing Level III

1.1. 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 **Electrical Worker** with competencies elaborated in the respective OS. Graduates of the program will have the required qualification to work in the **Electro - Technology** sector in the field of **electrical/electronic equipment servicing.**

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_Service and Repair mobile phones, Assemble and Erect Antenna and Signal Distribution Equipment, Maintain and repair television receivers, Maintain and repair Printers, Maintain and Repair digital copier machine, Maintain and Repair Computer, Maintain and Repair Refrigerator, Install and repair air conditioner, Prevent and Eliminate MUDA in accordance with the performance criteria and evidence guide described in the OS.

1.2. TVET-Program Training Outcomes

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

EIS EEES3 09 0322	Prevent and Eliminate MUDA
EIS EEES3 01 0322	Service and Repair mobile phones
EIS EEES3 02 0322	Assemble and Erect Antenna and Signal Distribution Equipment
EIS EEES3 03 0322	Maintain and repair television receivers
EIS EEES3 04 0322	Maintain and repair Printers
EIS EEES3 05 0322	Maintain and Repair digital copier machine
EIS EEES3 06 0322	Maintain and Repair Computer
EIS EEES3 07 0322	Maintain and Repair Refrigerator
EIS EEES3 08 0322	Install and repair air conditioner

1.3. Duration of the TVET-Program

The Program will have duration of **970-*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.	Service and Repair mobile phones	36	48	36	**120hr**	
2.	Assemble and Erect Antenna and Signal Distribution Equipment	24	32	24	**80hr**	
3.	Maintain and repair television receivers	51	68	51	**170hr**	
4.	Maintain and repair Printers	21	28	21	**70hr**	
5.	Maintain and Repair digital copier machine	24	32	24	**80hr**	
6.	Maintain and Repair Computer	30	40	30	**100hr**	
7.	Maintain and Repair Refrigerator	24	32	24	**80hr**	
8.	Install and repair air conditioner	15	20	15	**50hr**	
9.	Prevent and Eliminate MUDA	12	16	12	**40hr**	
Total hours		**237hrs**	**316hrs**	**237hrs**	**790hr**	

1.4. Qualification Level and Certification

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

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

1.5. Target Groups

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

1.7 Entry Requirements

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

1.8 Mode of Delivery

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

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

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

1.9. TVET-Program Structure

Unit of Competence	Module Code & Title	Training Outcomes	Duration (In Hours)
EISEEES3 09 0322 Prevent and Eliminate MUDA	**EISEEES3 09 0322** Prevent and Eliminate MUDA	• Prepare for work. • Identify MUDA and problem • Analyze causes of a problem. • Eliminate MUDA and Assess effectiveness of the solution. • Prevent occurrence of wastes and sustain operation.	**40hr**
EISEEES3 01 0322 Service and Repair mobile phones	**EISEEES3 01 0322** Servicing and Repairing mobile phones	• Prepare unit and workplace • Diagnose faults of cellular phone unit • Service/repair cellular phone unit • Test repaired unit Install additional/ enhancement features	**120hr**
EISEEES3 02 0322 Assemble and Erect Antenna and Signal Distribution Equipment	**EISEEES3 02 0322** Assembling and Erecting Antenna and Signal Distribution Equipment	• Prepare unit and workstation • Repair satellite receiver/decoder • Install satellite/ antenna system • Prepare to install and set up reception antennae and signal distribution systems • Install reception antennae and signal distribution systems • Set-up reception antennae and signal distribution systems and report	80hr
EISEEES3 03 0322 Maintain and repair television receivers	**EISEEES3 03 0322** Maintaining and repairing television receivers	• Prepare unit tools and workstation • Identify faults • Maintain/repair product(TV) • Test Functionality of repaired TV	170hr

				• Achieve productivity and quality target	
EISEEES3 04 0322	Maintain and repair Printers	**EISEEES3 04 0322**	Maintaining and repairing Printers	• Prepare tools and workstation • Diagnose faults • Maintain and repair printer • Test repaired product	70hr
EISEEES3 05 0322	Maintain and Repair digital copier machine	**EISEEES3 05 0322**	Maintaining and Repairing digital copier machine	• Prepare unit, tools and workstation • Diagnose faults • Maintain and repair digital copier • Test repaired product	80hr
EISEEES3 06 0322	Maintain and Repair Computer	**EISEEES3 06 0322**	Maintaining and Repairing Computer	• Plan and prepare for maintain and repair computers • Diagnose faults of computer systems • Rectify/correct defects in computer systems • Maintain computer systems • Inspect and test the computer systems	100hr
EISEEES3 07 0322	Maintain and Repair Refrigerator	**EISEEES3 07 0322**	Maintain and Repair Refrigerator	• Prepare to maintain/repair refrigeration unit • Diagnose faults • Maintain/repair refrigeration unit • Test repaired product • Complete work and report activities	80hr
EISEEES3 08 0322	Install and repair air conditioner	**EISEEES3 08 0322**	Install and repair air conditioner	• Prepare to install air conditioning systems • Select, install and terminate low voltage (LV) and extra-low voltage (ELV) cables • Install non-ducted split air conditioning systems • Locate and rectify faults and carry out maintenance • Commission air conditioning systems • Complete work and report activities	50hr

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 - 09

TVET-PROGRAMME TITLE: Electrical/Electronic Equipment Servicing level - III

MODULE TITLE: Preventing and Eliminating MUDA

MODULE CODE: EIS EEES3 M09 03222

NOMINAL DURATION: 40.Hours

MODULE DESCRIPTION:This module covers the knowledge, skills and attitude required by a worker to prevent and eliminate MUDA/wastes in his/her workplace by applying scientific problem-solving techniques and tools to enhance quality, productivity and other kaizen elements on continual basis. It covers responsibility for the day-to-day operation of the work and ensures Kaizen Elements are continuously improved and institutionalized.

LEARNING OUTCOMES

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

LO1. Prepare for work

LO2. Identify MUDA and problem

LO3. Analyze causes of a problem

LO4.Eliminate MUDA and Assess effectiveness of the solution

LO5.Prevent occurrence of wastes and sustain operation

MODULE CONTENTS:

LO1. Prepare for Work

1.1 Basic concept of kaizen

1.2 Using work instructions

1.3 OHS requirements

1.4 Selecting tools, equipment and material

LO2. Identify Muda and Problem

2.1 Preparing plan

2.2 Listing causes of a problem

2.3 Identifying and measuring wastes

LO3. **Analyze causes of a problem**

1.1 Analyzing causes by using 4M1E

1.2 Eliminating the root cause

LO4.**Eliminate MUDA and Assess Effectiveness of the Solution**

4.1 Adopting the basic principles for improvement

4.2 Reducing and eliminating wastes

4.3 Recording results.

LO5.**Prevent Occurrence of Wastes and Sustain Operation**

5.1. Preparing standards

5.2. Preventing occurrences of wastes

5.3. Creating waste-free workplace

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

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

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

ASSESSMENT CRITERIA:

LO.1Prepare for work

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

LO.2 Identify MUDA and problem

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

LO.3Analyze causes of a problem.

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

LO. 4 Eliminate MUDA and Assess effectiveness of the solution.

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

- Improvements gained by elimination of waste/MUDA are reported to relevant bodies.

LO.5 Prevent occurrence of wastes and sustain operation.

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

Annex: Resource requirement

EISE EES3 M09 0322: Preventing and Eliminating MUDA				
No.	**Category/Item**	**Description/ Specifications**	**Qty.**	**Recommended Ratio (Item: Trainee)**
A.	***Learning Materials(Disability inclusive learning guide)***			
1.	TTLM	prepared by trainer	25 Pcs	1:1
2.	Reference Books			
2.1	Gemba Kaizen	2nd Edition Masaaki Imai	5 Pcs	1:5
3.	Journals/Publication/Magazines	Published/unpublished	2 Pcs	1:12
B.	***Learning Facilities & Infrastructure***			
1.	Lecture room	6mX8m	1	1:25
2.	Workshop	10mx12m	1	1:25
3.	Library	105 – 180 m2 area Needed Per Trainee	1	1:25
4.	Instructional Audio video	Library/classroom location	It depends	1:1
5.	Visual training Media	LCD, Laptops	1 Pcs	1:25
6.	Teaching boards	White board ,Flip chart ,Smart board	1 Pcs	1:25
7.	Arm chair	55 Cm *74 Cm *100Cm	25 Pcs	1:1
8.	Notice board	120*100 Cm	1 Pcs	1:25
9.	White board	240 Cm *120 Cm	1 Pcs	1:25
C.	***Consumable Materials***			
1.	Dust masks	Plastic	25 Pcs	1:1
2.	Glove	Plastic	25 Pcs	1:1
3.	Working cloth	Tertian	25 Pcs	1:1
4.	First aid Kit	Per workshop	1 Kit	1:25
5.	Safety shoes	Leather	25 Pcs	1:1
6.	Paper	A4,A3,A2	5 Pack	1:2
7.	Pencil	0.5	50 Pack	2:1
8.	Flip chart	A1	1 Pcs	1:25
9.	Marker	Temporary/ Permanent	50 Pack	2:1
D.	***Tools and equipment***			
1.	Ruler	Scale	1 Pcs per shop	1:25

LEARNING MODULE 01
TVET-PROGRAMME TITLE: Electrical/Electronic Equipment Servicing Level III
MODULE TITLE: **Servicing and Repairing Mobile Phones**
MODULE CODE: EIS EEES3 M01 0322
NOMINAL DURATION: **120** Hours
MODULE DESCRIPTION: This module covers the competence required to service and repair cellular mobile phones including diagnosing faults, and preparing reports.
LEARNING OUTCOMES. At the end of the module the trainee will be able to: LO1. Prepare unit, workplace. LO2. Diagnose faults of cellular phone unit. LO3. Service/repair cellular phone unit. LO4. Test repaired cellular phone unit LO5. Install additional/ enhancement features
MODULE CONTENTS: **LO1. Prepare unit, tools, equipment and workstation.** 1.1. Basic concepts about cellular phone**.** **1.2.** Setting / arranging workplace for repair device **1.3.** Making ready necessary tools, test instruments and PPE. **1.4.** Acquiring service manuals and service information. **LO2. Diagnose faults of cellular phone unit.** **2.1** Types and Parts of cellular phone. 2.2, Methods of mobile phone faults finding. 2.3 Implementing proper troubleshooting procedures. 2.4.Conducting complete check-up of cellular phone unit 2.5 Following systematic pre-testing procedure 2.6 Verifying repair/maintenance the mobile unit 2.8 Common faults of cellular phone 2.9 Identifying system defect/fault symptoms. 2.9 Documenting results of diagnosis and testing.

2.10 Advising/informing Customers.

LO3. Service/repair cellular phone unit

3.1. Using personal protective equipment's.

3.2. Following electro-static discharge (ESD) protection procedure.

3.3. Replacing or swapping defective parts/components.

3.4. Soldering, mounting and repairing parts/components..

3.5. Flashing repaired units using appropriate application software.

3.6. Performing cleaning of unit.

LO4. Test repaired unit

4.1. Reassembling repaired units.

4.2. Testing and cleaning reassembled units.

4.3. Compiling documentations.

4.4. Disposing waste materials.

LO5. Install additional/ enhancement features

5.1 Installing enhancements and applications.

5.2 Advising/orienting customers.

LEARNING METHODS:			
For None Impaired Trainees	**Reasonable Adjustment for Trainees with Disability (TWD)**		
	Deaf	**Hard of hearing**	**Physical impairment**
Lecture-discussion	❖ 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	❖ use Sign language interpreter ❖ Use video recorded material ❖ Ensure attention of the trainees ❖ Provide structured training ❖ Show clear and short method ❖ Use gesture ❖ provide tutorial support (if necessary)	❖ Illustrate in clear & short method ❖ Use Video recorded material ❖ Ensure the attention of the trainees ❖ provide tutorial support (if necessary)	❖ Facilitate and support the trainees having severe upper limbs impairment to operate equipments/ machines ❖ Assign peer trainees to assist ❖ Conduct close follow up ❖ Provide tutorial support (if necessary

Group discussion	❖ 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/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	❖ use sign language interpreter ❖ provide briefing /orientation on the assignment ❖ provide visual recorded material	Provide briefing /orientation on the assignment Provide visual recorded material	
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 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	❖ Use sign language interpreter ❖ Brief on the instruction of the exam ❖ Provide activity-based/ practical assessment method ❖ Time extension	❖ Provide activity based assessment ❖ Brief on the instruction of the exam ❖ Use loud voice ❖ Time extension	❖ Provide activity based assessment ❖ Conduct close follow up ❖ Time extension

ASSESSMENT CRITERIA:

LO.1 Prepare unit and workplace

- Workplace is set/arranged for repair job in line with the company requirements and standards
- Necessary tools, test instruments and personal protective equipment are made ready in line with job requirements
- Service manuals and service information required for repair/maintenance are acquired at commencement of activities
- Repair/maintenance history of the unit is properly verified

LO.2 Diagnose faults of cellular phone unit

- Complete check-up of cellular phone is conducted and defects are identified, verified and documented against customer description
- Systematic pre-testing procedure is followed in accordance with manufacturer's instructions
- System defects fault symptoms are identified using appropriate diagnostic software, tools and equipment in accordance with manufacturers' specifications
- Chips are checked and isolated using specified testing procedures
- Proper troubleshooting procedures are implemented
- Identified defects and faults are explained to the responsible person in accordance with company policy and procedures
- Results of diagnosis and testing are documented accurately and completely within the specified time
- Customers are advised / informed regarding the status and serviceability of the unit

LO.3 Service/repair cellular phone unit

- Personal protective equipment's are used in accordance with Occupational Health and Safety practices
- Electro-static discharge (ESD) protection procedure is followed in accordance with current industry standards
- Defective parts/components are replaced with identical or recommended appropriate equivalent ratings
- Repaired or replaced parts/components are soldered/mounted in accordance with the current industry standards
- Control settings/adjustments are performed in conformity with service-manual specifications
- Repair activity is performed within the required timeframe
- Care and extreme precaution in handling the unit/product is observed as per procedures
- Cleaning of unit is performed in accordance with standard procedures

LO.4 Test repaired unit

- Repaired units are reassembled according to procedures
- Reassembled units are subjected to final testing and cleaning in conformity with manufacturer's

specifications

- Service completion procedures and documentations are complied with based on manual
- Waste materials are disposed of in accordance with environmental requirements.

LO.5 Install additional/ enhancement features.

- Enhancements and applications are installed to the unit based on customers' request and manufacturers' recommendation
- Customers' are advised/oriented on the operation of additional operator services that maybe availed of based on manufacturer's standards

EIS EEES3 M01 0322: Service and Repair Mobile Phones				
Item No.	**Category/Item**	**Description/ Specifications**	**Quantity**	**Recommended Ratio (Item: Trainee)**
A.	***Learning Materials***			
1.	TTLM	By trainer	5Pcs	1:5
	Reference Books	Electrical and Electronics.	5Pcs	1:5
	Journals/application magazines.		5Pcs	1:5
	ECG book	Volume1	5Pcs	1:5
	ECG book	Volume2	5Pcs	1:5
B.	***Learning Facilities & Infrastructure***			
1.	Library	10mx12m	1room	1:25
2	Class room with ramp	6mx8m	1room	1:25
3	Work shop with ramp	10mx8m	1room	1:25
4	Lift	If stair cases	1room	1:25
C.	***Consumable Materials***			
1.	Drawing Papers	White plane paper with size of A4,A3,A1&A2	25Pcs	1:1
2	Pencils	HP	25Pcs	1:1
3	Sharper	Any type	25Pcs	1:1
4	Jumper Wire	0.5mm,flexible	5 Roll	1:5
5	Jumper Wire	0.8mm,solid	5 Roll	1:5
6	Eraser	Gum type eraser	25Pcs	1:1
7	Thinner or PCB Cleaner	IPA or Isopropyl alcohol	1Liter	1:5
8	Cleaning sponge	ESD-Safe	25Pcs	1:1
9	Solder paste	Rosin	5Pcs	1:5
10	Liquid flux	Alpha Cookson product	5Liter	1:5
11	Solder Wire or lead	0.8mm^2	5Roll	1:5
12	Brush	ESD-Safe	25Pcs	1:1

13	Crystal oscillator	12MHz,8Mhz, 200KHz	25Pcs	1:1
D.	***Tools and Equipment***			
1.	Soldering iron	230v, Goot or Weller, withstand and 50 watt	25Pcs	1:1
2	Hot air blower	adjustable and ESD-Safe,480v,	5Pcs	1:5
3	Test JIG Box	ESD-Safe	5Pcs	1:5
4	Vibrator	ESD-Safe	5Pcs	1:5
5	PCB holder	Standard	5Pcs	1:5
6	Magnifying Lamp	Head Magnifier with LED Light and different magnification such as 3x, 4x, 5x, 10x, 50x etc	5Pcs	1:5
7	Mobile phone openers	Nonmetallic and ESD-Safe	25Pcs	1:1
8	Tweezers	Stainless steel and ESD-Safe	5Pcs	1:5
9	DC Power Supply	Regulated and variable, 30v	5Pcs	1:5
10	Battery Booster	Standard	5Pcs	1:5
11	Battery Tester	Standard	5Pcs	1:5
12	LCD Tester	Standard	5Pcs	1:5
13	Screwdriver	T4, T5, and T6, Flat and Philips, Plastic handle. set	25Pcs	1:1
14	Signal generator	AF/RF, 10x,50x,100x 150xHz	5Pcs	1:5
15	Microscope	Different zoom options such as 2X, 3X, 5X, 10X etc.	5Pcs	1:5
16	Signal connectors	Prob 10x,100x	5Pcs	1:5
16	Oscilloscope	150MHz, 200MHz, 220v/small/5mf	5Pcs	1:5
17	High-grade magnifying glass with lamp	Different magnification such as 3x, 4x, 5x, 10x, 50x etc	5Pcs	1:5
18	USB software flasher	2Tera byte	5Pcs	1:5
19	PC computer	HD 1tera byte, RAM 4GB,	5Pcs	1:5
20	Infrared workstation	With ventilation	5Pcs	1:5
21	Cell phone spare parts	Assorted for Smart phones	5Pcs	1:5

22	Multi-testers	Analog / Digital	5Pcs	1:5
24	Clamp meter	Digital	5Pcs	1:5
25	Work bench	Wood type,50mmx200mm	5Pcs	1:5
26	SIM Card Connect	Small & big	5Pcs	1:5
27	SIM Card cutter	Standard, and different size	5Pcs	1:5
28	Memory Card Connector	for any small mobile & big	5Pcs	1:5
29	Camera Connector	for any small mobile & big	5Pcs	1:5
30	Camera	for any small mobile & big	5Pcs	1:5
31	ON / OFF Switch	for any small mobile & big	5Pcs	1:5
32	Display (screen)	Small, for any small mobile & big	5Pcs	1:5
33	Display (screen)	for any small mobile & big	5Pcs	1:5
34	Display d a t a connector	for any small mobile & big	5Pcs	1:5
35	Network Antenna	for any small mobile & big	5Pcs	1:5
36	Network IC For mobile	for any small mobile & big	5Pcs	1:5
37	Power IC For mobile	for any small mobile & big	5Pcs	1:5
38	Charger IC For mobile	for any small mobile & big	5Pcs	1:5
39	Wrist strap	Antistatic	25Pcs	1:1
40	Working clothes/apron	Gowen	25Pcs	1:1
42	Face/dust mask	standard	25Pcs	1:1
43	Goggles	Transparent	25Pcs	1:1

LEARNING MODULE 02
TVET-PROGRAMME TITLE: **Electrical/Electronic Equipment Servicing III**
MODULE TITLE: **Assembling and Erecting Antenna and Signal Distribution Equipment**
MODULE CODE: **EIS EEES3 M02 0322**
NOMINAL DURATION : **80 Hours**
MODULE DESCRIPTION : This module covers the installation, positioning and securing of terrestrial, satellite arrays and dish associated amplifiers, the reticulation of cables connection of multiple access outlets and associated equipment. It encompasses safe working practices, selection of antennae and distribution components, installation techniques and use of testing devices.
LEARNING OUTCOMES At the end of the module the trainee will be able to: **LO1.** Prepare unit and workstation **LO2.** Repair satellite receiver/decoder **LO3**. Install satellite/ antenna system **LO4.** Prepare to install and set up reception antennae and signal distribution systems **LO5.** Install reception antennae and signal distribution systems **LO6.** Set-up reception antennae and signal distribution systems and report.
MODULE CONTENTS: **LO1. Prepare unit and workstation** 1.1. Preparing workplace 1.2. Basic concept of satellite antenna and TV system 1.3. Identifying PPT and necessary tools, test instruments 1.4. Preparing service manuals and service information **LO2. Repair satellite receiver/decoder** 2.1 Reading and interpreting drawings of circuit 2.2 Inspecting and checking units 2.3 Using service manuals and service information 2.4 Identifying repair hardware and upload software

LO3. Install satellite/ antenna system

3.1 Antenna installation and servicing

3.2 Coaxial cable installation and terminations

3.3 Performing operational check

3.4 Determining azimuth and elevation

3.5 Determining location of satellite / antenna

3.6 Assembling petals/arms of the dish and LNB unit

3.7 Tightening dish/antenna

3.8 Connecting and disconnecting signal finder

LO4. Prepare to install and set up reception antennae and signal distribution systems

4.1 Applying OHS procedures

4.3 Identifying safety hazards and risk control

4.4 Obtaining nature and location of the work

4.5 Requiring supervisor advice

4.6 Establishing sources of materials

4.7 Obtaining and checking equipment and testing devices

LO5. Install reception antennae and signal distribution systems

5.1 Checking circuits/components

5.2 Determining optimum location for an antenna

5.3 Installing accessories

5.4 Terminating cables and conductors

5.5 Following supervisor procedures and directions

5.6 Carrying out installation

LO6. Set-up reception antennae and signal distribution systems and report.

6.1 Following OHS and risk control measures

6.2 Completing adjustments of antenna

6.3 Cleaning and completing work site

6.4 Notifying work supervisor

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

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

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

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

ASSESSMENT CRITERIA:

LO.1 Prepare unit and workstation

- Workplace is made ready in accordance with work / job requirements
- Necessary tools, test instruments and personal protective equipment are made ready in line with job requirements
- Units are visually inspected and checked for physical defects
- Service manuals and service information required for the job are acquired at commencement of activities

LO.2 Repair satellite receiver/decoder

- Workplace is made ready in accordance with work / job requirements
- Necessary tools, test instruments and personal protective equipment are made ready in line with job requirements
- Units are visually inspected and checked for physical defects
- Service manuals and service information required for the job are acquired at commencement of activities
- Repair hardware and upload software according to the fault identified

LO.3 Install satellite/ antenna system

- Location of satellite / antenna for good reception is determined
- Petals/arms of the dish is assembled and LNB unit fixed according to operating manual
- Dish/antenna is tightened firmly with stand after optional signal obtained
- Signal finder is connected /disconnected between LNB and satellite /antenna receiver to tune until the system obtain maximum output
- Operational check is performed according to manual
- Azimuth and elevation is determined using service manual

LO.4 Prepare to install and set up reception antennae and signal distribution systems

- Personal protective equipment's is used in accordance with Occupational Health and Safety practices
- Defective parts/components are replaced with identical or recommended appropriate

equivalent ratings

- Repaired or replaced parts/components are soldered/mounted in accordance with the current industry standards
- Repair activity is performed within the required time frame
- Care and extreme precaution in handling the unit/product is observed as per procedures
- Cleaning of unit is performed in accordance with standard procedures

LO.5 Install reception antennae and signal distribution systems

- OHS procedures for a given work area are identified, obtained and understood through established routines.
- Established OHS risk control measures are followed in preparation for the work.
- Safety hazards, which have not previously been identified, are reported and advise on risk control measures, are sought from the work supervisor.
- The nature and location of the work is obtained from work supervisor or other appropriate person to establish the scope of work to be undertaken.
- Advice is sought from the work supervisor and/or other appropriate person to ensure the work is coordinated effectively with others.
- Sources of materials that may be required for the work are established in accordance with established routines.
- Tools, equipment and testing devices needed to carry out the work are obtained and checked for correct operation and safety.

LO.6 Set-up reception antennae and signal distribution systems and report.

- OHS work completion risk control measures and procedures are followed.
- Adjustments are made to the antenna and the system to optimize reception at each outlet.
- Work site is cleaned and made safe in accordance with established procedures.
- Work supervisor is notified of the completion of the installation work in accordance with established routines.

Annex: Resource Requirements

EIS EEES3 M02 0322 and **Assembling and Erecting Antenna and Signal Distribution Equipment**				
Item No.	**Category/Item**	**Description/ Specifications**	**Quantity**	**Recommended Ratio (Item: Trainee)**
A.	***Learning Materials***			
1.	Manuals/TTLM	By trainor	5	1:5
2.	working benches	Wooden	5	1:5
3	Fundamental of television and radio		5	1:5
B.	***Learning Facilities & Infrastructure***			
1.	Library	10mx12m	1room	1:25
2.	Class room with ramp	6mx8m	1room	1:25
	Work shop with ramp	10mx8m	1room	1:25
C.	***Consumable Materials***			
1.	Stationary	A4 paper	25 pkt	1:1
2	flux	liquid	5 pcs	1:5
5	solder	40/60	5 pcs	1:5
6	wire	standard	5 pcs	1:5
D.	***Tools and Equipments***			
1.	Soldering irons	25w	5pcs	1:5
2.	Hand drill	Standard	5pcs	1:5
3.	Power drill	Standard AC/DC	5pcs	1:5
4.	Drill bits	Standard	5pcs	1:5
5.	Screwdriver (assorted)	Set	5 set	1:5
6.	Wrenches (assorted)	Set	5 set	1:5
7.	Allen wrench/key	Set	5 set	1:5
8.	utility knife/stripper	Standard	5 pcs	1:5
9.	Pliers, Taps and dies	Standard	5 pcs	1:5
10	AC Power supply	220v variable	5 pcs	1:5
11	Divider	Standard 5 o/p	5 pcs	1:5
12	Soldering irons	220v 25w	5pcs	1:5

LEARNING MODULE 03

TVET-PROGRAMME TITLE: **Electrical/Electronic Equipment Servicing III**

MODULE TITLE: **Maintain and repair television receivers**

MODULE CODE: **EIS EEES2 M03 0322**

NOMINAL DURATION : **170 Hours**

MODULE DESCRIPTION: This module covers the knowledge, skills and attitudes required to maintain and repair the TV, decipher the symptoms and diagnose the problems in the TV by inspecting its various modules and sections depending on the type of the television set such as CRT/LED/LCD /plasma TV including diagnosing faults, reassembling, testing and preparing reports.

LEARNING OUTCOMES

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

LO1 Prepare unit tools and workstation

LO2. Identify faults

LO3. Maintain/repair product(TV)

LO4. Test Functionality of repaired TV

MODULE CONTENTS:

LO1 Prepare unit tools and workstation

1.1. Basic concept of television
1.2. Preparing workstation, tools, test instruments and PPE
1.3. Using service manuals and service information
1.4. Identifying , verifying and documenting of defects parts

LO2. Identify faults

2.1 Observing systematic pre-testing procedure
2.2 Diagnosing the fault in the unit
2.3 Assembling and disassembling of TV unit
2.4 Connecting and ensuring the plug point to the TV set
2.5 Unpluging the power supply and any other equipment
2.6 Identifying system defects/fault symptoms
2.7 Carrying out basic earthling test and volt ampere test

2.8 Discharging any large capacitor and cathode ray tube before diagnosis

2.9 Locating the exact location of the fault

2.10 Checking and isolating circuits using specified testing procedures

2.11 Documenting diagnosis and testing results

2.12 Advising / informing customers

LO3. Maintain/repair product(TV)

3.1 Using Personal protective equipment

3.2 Maintain and Repair Television products

3.3 Troubleshooting of television

3.4 Identifying faults on the PCBs

3.5 Disassembling the TV set,

LO4. Test functionality of repaired TV

4.1 Reading and interpreting electronic schematic symbols and diagram

4.2 Reassembling and repairing TV units

4.3 Supplying and confirming power supply

4.4 Testing functionality of TV unit

4.5 Disposing waste materials

LO5. **Achieve productivity and quality targe**

5.1 Rectifying repeated routine faults in the TV

5.2 Recording Customer complaints post service

5.3 Achieving Customer satisfaction

5.4 Orienting customers to follow correct practices

5.5 Ensuring Free handling of the unit to avoid damag

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:

LO.1 Prepare unit tools and workstation

- Necessary tools, test instruments and personal protective equipment are prepared in line with job requirements
- Workstation is set/prepared for repair job in line with the company requirements and work specifications
- Service manuals and service information required for repair/maintenance are acquired as per standard procedure
- Repair/maintenance television history is verified in line with the company procedures
- Complete check-up of CRT,LCD and LED is conducted and defects are identified, verified and documented against customer description

LO.2 Identify faults

- Systematic pre-testing procedure is observed in accordance with manufacturer's instructions
- Diagnose the fault in the unit in accordance with OHS requirements, legislation & regulations as per customer interaction and initial inspection
- Check the plug point to which the TV set is connected and ensure that the power supply module in the TV set is receiving power
- Unplug the power supply and any other equipment connected to the TV, e.g., set top box, DVD player, computer, home theatre
- Carry out basic earthling test and volt ampere test and ensure that the fault is internal before disassembling the unit
- Discharge any large capacitor and the charge stored in the cathode ray tube before diagnosis
- Locate the exact location of the fault by examining various modules of the TV such as the power supply board, the main board, speakers, etc.
- Follow the path of current to identify in which section the defect has occurred before troubleshooting a circuit
- System defects/fault symptoms are identified using appropriate tools and equipment and in accordance with safety procedures
- Test instruments required for the job are used in accordance with user manuals
- Circuits are checked and isolated using specified testing procedures
- Identified defects and faults are explained to the ***responsible person*** in accordance with enterprise or

company policy and procedures

- Control settings/adjustments are checked in conformity with service-manual specifications
- Results of diagnosis and testing are documented accurately and completely within the specified time
- Customers are advised / informed regarding the status and serviceability of the unit according to company procedures

LO.3 Maintain/repair product(TV)

- Personal protective equipment is used in accordance with Occupational Health and Safety practices
- Fault are identified due to a problem in one of the PCBs within the TV set, remove the PCB and replace it with a functional one
- The dysfunctional module/part is specialized and cannot be replaced immediately, remove and replace during second visit with a functional one as collected from the service centre
- Defective parts/components are replaced with identical or recommended appropriate equivalent ratings
- Repaired or replaced parts/components are soldered/mounted in accordance with the current industry standards
- Control settings/adjustments are performed in conformity with service-manual specifications
- Repair activity is performed within the required timeframe
- Care and extreme precaution in handling the unit/product is observed as per procedures
- Cleaning of unit is performed in accordance with standard procedure

LO.4 Test Functionality of repaired TV

- Repaired units are reassembled according to manufacturer's specifications
- Reassembled units are subjected to final testing and cleaning in conformity with manufacturer's specifications
- Power supplied and confirmed that the unit is functioning as per specifications
- Tested functionality of the unit with the customer Service completion procedures and documentations are complied with based on workplace requirements
- Waste materials are disposed of in accordance with environmental requirements

LO.5 Achieve productivity and quality target

- Repeated routine faults in the TV are rectified to avoid malfunctioning
- Met daily target for attending to number of complaints
- Customer complaints post service are recorded
- Customer satisfaction are achieved
- customers are oriented to follow correct practices in order to avoid repeated problems

- Free handling of the unit is ensured to avoid damage

Annex: Resource Requirements

EIS EEES2 03 0322 : Maintain and repair television receivers				
Item No.	**Category/Item**	**Description/ Specifications**	**Quantity**	**Recommended Ratio (Item: Trainee)**
A.	***Learning Materials***			
1.	TTLM	prepared by the trainer	25pcs	1:1
2.	Reference Books			
2.1	Audio Video Systems Principles Practices and Troubleshooting.	S P Bali Rajeev Bali Kahanna Book Publishing CO.LTD	5pcs	1:5
2.2	Audio and Video Systems Principles Maintenance and Troubleshooting	R G Gupta TATA McGraw	5 pcs	1:5
2.3	Modern Television Practice ,Principle, Technology &Servicing	R.R.GULATI New Age International(p)Limited	5 pcs	1:5
2.4	Television Principles & Practice 1997	J..S Zarach&NoelemM.Morl s	5 pcs	1:5
.	Journals/Publication/Magazines	Technology	5pcs	1:5
B.	***Learning Facilities & Infrastructure***			
1.	Lecture /Class room	6x8 m	1Room	1:25
2.	Laboratory/work shop room	10x10m	1Room	1:25
3.	Library	10x10m	1Room	1:25
C.	***Consumable Materials***			
1.	Audio IC	TDA1514A, TDA7266	25 pcs	1:1
2	Vertical IC	LA78040/LA78141,LA7 845,LA7846	50 pcs	2:1
5	Horizontal IC	TDA2595/TDA8214B, D2499/1879/5446/1877 C5966	100 pcs	4:1

6	Power transistor	2SD1047/2SD587 Different type	25 pcs	1:1
8	Diode	KB307/2N007…	100 pcs	4:1
9	Capacitor	Diferent type	200 pcs	8:1
10	Resistor	Different type	200 pcs	8:1
11	Transformer	9v,12v,5v,6v,24v	25 pcs	1:1
12	Fuse	3.1A,5A,7A,10A	25 pcs	1:1
13	Soldering lead etc	0.8mm^2	25 pcs	1:1
14	Zener diodes	3.6V,5.1V,6.8V,7.5V,9. 1V/12V,18V,24V	200 pcs	8:1
15	Bridge rectifier	D2SB60, TS4B05G	50pcs	2:1
16	Switching transistor (STR)	X6756,6151, STR- S6707 /09, TR-F6654 / 58, STR-W6754	125 pcs	5:1
17	Photo coupler	PC-17L1,PC817	50 pcs	2:1
18	Error amplifier IC	SE110,SE115,SE120	75 pcs	3:1
19	Regulator IC	KIA 7806,PQ12,RF21	100 pcs	4:1
20	Power relay	DC5V,12V	50 pcs	2:1
21	EEPROM	KSC24C02/04/06/08/16	25 pcs	1:!
22	Reset IC	KIA7042/7542	25 pcs	1:!
23	Crystal Oscillator(X-TAL)	500F2,B503	50 pcs	1:1
24	Fly back transformer (FBT)	6174V,60002D	5 pcs	1:5
25	OP AMP IC	KIA358,TDA8145	50 pcs	2:1
26	Tuner of TV RX	6700VNFNS11E/010C	5 pcs	1:5
27	AUDIO AMP IC	LM358	25 pcs	1:1
28	F connector	Pass band 0hz to 2.15 GHz	25 pcs	1:1
29	PAL connector	Male	25pcs	1:1
30	PAL connector	Female	25pcs	1:1
31	S-Video	Male	25pcs	1:1
32	S-Video	Female	25pcs	1:1
33	BNC connector	Female	25pcs	1:1
34	BNC connector	Male	25pcs	1:1

35	HDMI cable	1meter	25pcs	1:1
36	Crystal oscillator	12MHz	25Pcs	1:1
37	Crystal oscillator	8 MHz	25Pcs	1:1
38	Crystal oscillator	200 kHz	25Pcs	1:1
39	UNIVERSAL TV BOARD	14",21"	25 Pcs	1:1
40	Tweezers	6 PCS in one set, Length 120 mm	25 Pcs	1:1
41	Mobile phone	Different type	25 Pcs	1:1
42	Electro-static discharge (ESD)	0A 50 to < 125 voltage	25 Pcs	1:1
43	Working clothes/apron	Tetron 6000	25 Pcs	1:1
44	Face/dust mask	N1	25 Pcs	1:1
45	Goggles	Resisting impact from a 6.35mm(1/4 inch)	25 Pcs	1:1
D.	***Tools and Equipments***			
1.	CRT Television	21,24,48,52 inch	25 Pcs	1:1
2	LED Television	21,24,48,52 inch	25 Pcs	1:1
3	LCD Television	21,24,48,52,inch	25 Pcs	1:1
4	Plasma TV	21,48,52 inch	25 Pcs	1:1
5	variable power supply	AC/DC 220C/0-30v	25 Pcs	1:1
6	TV pattern generator	150Mhz	25 Pcs	1:1
7	step-down transformer	9v,12v,24v	25 Pcs	1:1
8	soldering iron/gun	220v,adustment	25 Pcs	1:1
9	Dis soldering tools	standard	25 Pcs	1:1
11	multi meter-testers	(analog/digital)	25 Pcs	1:1
12	utility knife/stripper	Standard	25 Pcs	1:1
14	Cables/connectors	Male/female	25 Pcs	1:1
15	high-grade magnifying glass with lamp	10x,50x,100x	25 Pcs	1:1
16	flashlight	Standard	25 Pcs	1:1
17	cleaning brush	Standard	25 Pcs	1:1
18	high voltage probe	450v	25 Pcs	1:1

19	soldering lead	0.8mm^2	25Pcs	1:1
20	wires	0.8mm^2 , 1.5mm^2	25Pcs	1:1
21	assorted electronic components	Different type	25Pcs	1:1
22	Contact Cleaner	Standard	25Pcs	1:1
23	Tweezers	Standard	25Pcs	1:1
24	Silicon Grease	Standard	25Pcs	1:1
25	Insulation tester w/ stand	Analog /digital	25Pcs	1:1

LEARNING MODULE 04

TVET-PROGRAMME TITLE: **Electrical/Electronic Equipment Servicing Level III**

MODULE TITLE: **Maintain and repair Printers**

MODULE CODE: **EISE EES3 M04 0322**

NOMINAL DURATION:-**70- Hours**

MODULE DESCRIPTION: This module covers the knowledge, skills and attitudes required to maintain and repair printing machines including diagnosing faults, reassembling, testing and preparing reports.

LEARNING OUTCOMES

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

LO1. Prepare tools and workstation

LO2. Diagnose faults

LO3. Maintain and repair printer

LO4. Test repaired product

MODULE CONTENTS:

LO1 Prepare unit, tools and workstation.

1.1 Basic concepts of printer machines

1.1.1 Introduction to printer machines

1.1.2 Parts of printer machines

1.1.3 Classification and types of printer machine

1.2 Preparing workstation and work specifications for repair job

1.3 Preparing necessary tools and test instruments with PPE

1.4 Requiring and obtaining Service manuals for repair/maintenance

1.5 Verifying repair/maintenance history.

1.5.1 External view of printer machines.

1.5.2 Basic printer machines sensor types

1.5.3 Basic printer machines components

1.5.4 Image formation process

1.6 Conducting complete check-up of printer machines

LO2. Diagnose faults

2.1 Observing systematic pre-testing procedure

2.1.1 Visual inspection of the unit with power off

2.1.2 Interview of customer re history of unit

2.1.3 Operate the unit according to manual to confirm defects

2.2 Disassembling the unit

2.3 Identifying system defects/ fault symptoms.

2.4 Checking and isolating circuits

2.5 Identifying defects and faults.

2.6 Checking control settings/adjustments.

2.7 Completing documentation.

2.8 Advising/ informing customers.

LO3. Maintain and repair printer

3.1 Using PPE & OHS practices.

3.2 Soldering/mounting and Repairing defective parts & components

3.3 Performing control settings/adjustments

3.4 Repairing parts/components od the device

3.5 Observing care and extreme precaution in handling the unit/product

3.6 Performing cleaning of unit

LO4: Test repaired product

4.1 Repairing and reassembling units.

4.2 Testing and cleaning the final reassembling units

4.3 Compiling documentations.

4.4 Disposing waste materials.

LEARNING METHODS: Disability Inclusive Learning Modules			
For None Impaired Trainees	**Reasonable Adjustment for Trainees with Disability (TWD)**		
	Deaf	**Hard of hearing**	**Physical impairment**
Lecture-discussion	❖ 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	❖ use Sign language interpreter ❖ Use video recorded material ❖ Ensure attention of the trainees ❖ Provide structured training ❖ Show clear and short method ❖ Use gesture	❖ Illustrate in clear & short method ❖ Use Video recorded material ❖ Ensure the attention of the trainees ❖ provide tutorial support (if necessary)	❖ Facilitate and support the trainees having severe upper limbs impairment to operate equipments/ machines ❖ Assign peer trainees to assist ❖ Conduct close follow up ❖ Provide tutorial support

	❖ provide tutorial support (if necessary)		(if necessary
Group discussion	❖ 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/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	❖ use sign language interpreter ❖ provide briefing /orientation on the assignment ❖ provide visual recorded material	Provide briefing /orientation on the assignment Provide visual recorded material	

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 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	❖ 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 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

ASSESMENT CRITERIA:

LO1. Planning and preparing to construct/ electrical/electronic circuits

- Necessary tools, test instruments and personal protective equipment are prepared in line with job requirements
- Workstation is set/prepared for repair job in line with the company requirements and work specifications
- Service manuals and service information required for repair/maintenance are acquired as per standard procedure
- Repair/maintenance history is verified in line with the company procedures
- Complete check-up of printer machines is conducted and defects are identified, verified and documented against customer description

LO2. Diagnose faults

- Systematic pre-testing procedure is observed in accordance with manufacturer's specifications
- The unit is disassembled based on the manufacturer's instruction
- System defects/fault symptoms are identified using appropriate tools and equipment and in accordance with safety procedures
- Test instruments required for the job are used in accordance with user manuals
- Faults are checked and isolated using specified testing procedures
- Identified defects and faults are explained to the responsible person in accordance with enterprise or company policy and procedures
- Control settings/adjustments are checked in conformity with service-manual specifications
- Results of diagnosis and testing are documented accurately and completely within the specified time
- Customers are advised/informed regarding the status and serviceability of the unit according to company procedures

LO3: .Maintain and repair printer

- Personal protective equipment is used in accordance with Occupational Health and Safety practices
- Electro-static discharge (ESD) protection procedure is followed in accordance with current industry standards

- Defective parts/components are replaced with identical or recommended appropriate equivalent ratings
- Repaired or replaced parts/components are soldered/mounted in accordance with the current industry standards
- Control settings/adjustments are performed in conformity with service-manual specifications
- Repair activity is performed within the required timeframe
- Test functionality of repaired part/components
- Care and extreme precaution in handling the unit/product is observed as per procedures
- Cleaning of unit is performed in accordance with standard procedures

LO4. Test repaired product

- Repaired units are reassembled according to manufacturer's specifications
- Reassembled units are subjected to final testing and cleaning in conformity with manufacturer's specifications
- Service completion procedures and documentations are complied with based on workplace requirements
- Waste materials are disposed of in accordance with environmental requirements

A11. Resource requirement

EIS EEES3 M04 0322: Maintain and Repair Printer				
Item No	**Category /Item**	**Description / Specification**	**Quality**	**Recommendation (Item, Training)**
A	***Learning Material***			
1	TTLM	By trainor	5pcs	1 : 5
2	Text Book	Used for student	5pcs	1 : 5
3	Visual training Media	LCD projector ,PC	5Pcs	1:25
4	Reference Book	Fundamental of television and radio	5pcs	1 : 5
B	***Learning Facility& Infrastructure***			
1	Library	10mx12m	1room	1:25
2	Class room with ramp	6mx8m	1room	1:25
3	Work shop with ramp	10mx8m	1room	1:25
4	Company	Electrical work station	1pcs	1 : 5
C	***Consumable Material***			
1.	Soldering lead	40 by 60 tin lead/1.5mm/	10Roll	1 : 1
2.	Flux	Rosin SP-44	10pcs	1 : 1
3.	stranded wires	1.5 mm^2 and 2.5 mm^2	10Roll	1 : 1
4.	Grease	Silicon Grease	10Gallons	1 : 1
5	Paper	A4	15pcs	1 : 1
5	Wire	d/t color& d/t size	10pcs	1 : 1
D	***Tools & Equipment's***			
1	Pliers	Different type standard set	10PCS	1 : 5
2	Cutters	Standard set	10PCS	1 : 5
3	Screw drivers	set	10PCS	1 : 5
4	Screw drivers	With flat tip and fully insulated	10PCS	1:5
5	Electric blower	Standard	10PCS	1:5
6	Soldering gun	220V,50Hrz,25,40,60,100W	10PCS	1:5

7	ESD-free work bench with mirror	Standard	5PCS	1:1
7	Variable power supply	1 phase or 3- phase	5PCS	1:1
12	Multi-tester	DC V range 0.2,20,200,500v AC V range 7.5,25,75,230,750v DC current range 0.2,5,10,30Am AC current range 2,20,200Am Ohmmeter 200Ohm,2K ohm,200K ohm,20M ohm	5pcs	1 : 1
13	Soldering gun	Standard	5pcs	1 : 1
11	ESD-free work bench with mirror	Standard	5PC	1:1
13	RCA cables/connectors	Standard	5Pc	1:1
14	glass with lamp	1-phase ,220v AC	5Pc	1:1
15	high-grade magnifying glass with lamp	1-phase 220v AC	5Pc	1:5
16	Flashlight	Standard	5Pc	1:1
17	cleaning brush	Sponge	5Pc	1:1
18	high voltage probe	1-phase 220v AC	5Pc	1:1
E	**Personal protective Equipment**			
1	working clothes/apron	Coton/caki	25pcs	1 : 1
2	hand gloves	Lather	25pcs	1 : 1
3	face/dust mask	Sergery mask	25pcs	1 : 1
4	Goggles	standard	25pcs	1 : 1
5	safety shoes	standard	25pcs	1 : 1
F	**parts/components**			
1	Passive components	Different type	25Pcs	1:1
2	Active components	Different type	25Pcs	1:1
3	Logic gates	Different type	25Pcs	1:1
4	IC's	Different type	25Pcs	1:1

LEARNING MODULE 05

TVET-PROGRAMME TITLE: **Electrical/Electronic Equipment Servicing Level III**

MODULE TITLE: **Maintaining and Repairing Digital Copier Machine**

MODULE CODE: **EISE EEES3 M05 0322**

NOMINAL DURATION:-**80-** Hours

MODULE DESCRIPTION: This module covers the knowledge, skills and attitudes required to maintain and repair Digital copier machine including diagnosing faults, repairing and testing and preparing reports.

LEARNING OUTCOMES

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

LO1: Prepare unit, tools and workstation
LO2. Diagnose faults
LO3. Maintain and repair digital copier
LO4,. Test repaired product

MODULE CONTENTS:

LO1 Prepare unit, tools and workstation.

1.3 Preparing necessary tools, test instruments & personal protective equipment.
1.4 Basic concept of copier machine
1.5 Preparing workstation and work specifications
1.6 Verifying repair/maintenance history.
1.3.1. Introduction of digital Copier machine.
1.3.2. Principle of operations of CCD
1.3.3. External view of digital Copier machine.
1.3.4. Basic digital copier machine sensor types
1.3.5. Basic copier components
1.3.6. Image formation process
1.7 Repairing electronic equipment using Service manuals
1.8 Identifying and conducting defects parts of digital Copier machine.

LO2. Diagnose faults

2.1 Observing systematic pre-testing procedure
2.2 Disassembling copy-printer parts.
2.3 Identifying defects and faults symptoms.
2.4 Using test instruments with user manuals.
2.5 checking and isolating Circuits
2.6 Checking Control settings/adjustments.

2.7 Completing documentation.

2.8 Advising Customers.

LO3. Maintain and repair digital copier

3.1 Using Personal protective equipment

3.2 Soldering and replacing defective parts/components .

3.2.1. Maintain/ repair digital copier machine

3.2.2. Common defects/fault symptoms

3.2.3. Technical data of Digital Copier Machine.

3.3. performing repair activity

3.4. Performing Control settings/adjustments

3.5. Observing and handling extreme precaution of unit/product.

3.6. performing & cleaning of digital copier Machine

LO4: Test repaired product

4.1 Testing and cleaning of reassembling units

4.2 Compiling documentations.

4.3 Disposing waste materials.

Learning Methods:				
For none mpaired 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 o be accessible to trainees ❖ Write short notes on the black/white board sing large text ❖ Make sure the luminosity of the light of class oom is kept ❖ Use normal tone of voice ❖ Encourage trainees to record the lecture in udio format ❖ Provide Orientation on the physical feature of he work shop ❖ Summarize main points	❖ Assign sign language nterpreter ❖ Arrange the class room eating to be conducive for eye to eye ontact ❖ Make sure the luminosity of he light of class room is kept ❖ Introduce new and relevant ocabularies ❖ Use short and clear sentences ❖ Give emphasis on visual ecture and ensure the attention of the rainees ❖ Avoid movement during ecture time ❖ Present the lecture in video ormat ❖ Summarize main points	❖ Organize the class oom seating arrangement to e accessible to trainees ❖ Speak loudly ❖ Ensure the ttention of the trainees ❖ Present the lecture n video format ❖ Ensure the ttention of the trainees	❖ Organize the lass room seating rrangement to be ccessible for heelchairs users. ❖ Facilitate and upport the trainees who ave severe impairments n their upper limbs to ake note ❖ Provide Orientation on the hysical feature of the ork shop

Demonstration	❖ Conduct close follow up ❖ Use verbal description ❖ Provide special attention in the process of uidance ❖ facilitate the support of peer trainees ❖ Prepare & use simulation ❖ Use video	❖ use Sign language interpreter ❖ Use video recorded material ❖ Ensure attention of the rainees ❖ Provide structured training ❖ Show clear and short method ❖ Use gesture ❖ ovide tutorial support (if necessary)	❖ Illustrate in clear & short method ❖ Use Video ecorded material ❖ Ensure the ttention of the trainees ❖ ovide tutorial support (if necessary)	❖ Facilitate and upport the trainees aving severe upper mbs impairment to perate equipments/ achines ❖ Assign peer rainees to assist ❖ Conduct close ollow up ❖ ovide tutorial support (if necessary
Group discussion	❖ Facilitate the integration of trainees with group nembers ❖ Conduct close follow up ❖ Introduce the trainees with other group nember ❖ Brief the thematic issues of the work	❖ Use sign language interpreters ❖ Facilitate the integration of rainees with group members ❖ Conduct close follow up ❖ Introduce the trainees with ther group member	❖ Facilitate the ntegration of trainees with roup members ❖ Conduct close ollow up ❖ Introduce the rainees with other group nember ❖ Inform the group	❖ Introduce the rainees with their peers

			nembers 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 uidance ❖ Provide tutorial support if ecessary ❖ provide special attention in he process/practical training ❖ Introduce new and relevant ocabularies	❖ Conduct close ollow up and guidance ❖ Provide tutorial upport if necessary ❖ provide special ttention in the process/ ractical training	❖ Assign peer rainees ❖ Use additional ominal hours if ecessary
Individual assignment	❖ prepare the assignment questions in large text ❖ Encourage the trainees to prepare and submit he assignment in large texts ❖ Make available recorded assignment questions ❖ Facilitate the trainees to prepare and submit he assignment in soft or hard copy	❖ Use sign language interpreter ❖ Provide briefing /orientation n the assignment ❖ Provide visual recorded naterial	❖ Provide briefing rientation on the ssignment ❖ Provide visual ecorded material	

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

ASSESSMENT CRITERIA:

LO.1: Prepare unit, tools and workstation.

- Complete check-up of audio systems and products is conducted and defects are identified, verified and documented against customer description
- Repair/maintenance history is verified in line with the company procedures
- Service manuals and service information required for repair/maintenance are acquired as per standard procedure
- Workstation is set/prepared for repair job in line with the company requirements and work specifications
- Necessary tools, test instruments and personal protective equipment are prepared in line with job requirements

LO.2 : Diagnose faults

- Systematic pre-testing procedure is observed in accordance with manufacturer's instructions
- System defects/fault symptoms are identified using appropriate tools and equipment and in accordance with safety procedures
- Test instruments required for the job are used in accordance with user manuals
- Circuits are checked and isolated using specified testing procedures
- Identified defects and faults are explained to the responsible person in accordance with enterprise or company policy and procedures
- Control settings/adjustments are checked in conformity with service-manual specifications
- Results of diagnosis and testing are documented accurately and completely within the specified time
- Customers are advised / informed regarding the status and serviceability of the unit according to company procedures

LO.3: **Install and repair product**

- Personal protective equipment is used in accordance with Occupational Health and Safety practices
- Electro-static discharge (ESD) protection procedure is followed in accordance with current industry standards
- Defective parts/components are replaced with identical or recommended appropriate equivalent ratings
- Repaired or replaced parts/components are soldered/mounted in accordance with the current industry standards
- Install and configure multimedia components/equipment's
- Control settings/adjustments are performed in conformity with service-manual specifications
- Repair activity is performed within the required timeframe
- Care and extreme precaution in handling the unit/product is observed as per procedures
- Cleaning of unit is performed in accordance with standard procedures.

LO.4 : **Test repaired product**

- Repaired units are reassembled according to manufacturer's specifications
- Reassembled units are subjected to final testing and cleaning in conformity with manufacturer's specifications
- Service completion procedures and documentations are complied with based on workplace requirements
- Waste materials are disposed of in accordance with environmental requirements.

Annex: Resource Requirements

EISE EES3 M05 0322 : Maintaining and Repairing Digital Copier Machine				
Item No.	**Category/Item**	**Description/ Specifications**	**Quantity**	**Recommended Ratio (Item: Trainee)**
A.	***Learning Materials***			
1.	TTLM	prepared by the trainer	25	1:1
2.	Reference Books	Practical Electronics Fault Finding and Troubleshooting	ROBIN PAIN	1:1
4.	Journals/Publication/Magazines		5	1:1
B.	***Learning Facilities & Infrastructure***			
1.	Library	10mx12m	1room	1:25
2.	Class room with ramp	6mx8m	1room	1:25
3.	Work shop with ramp	10mx8m	1room	1:25
C.	Company	Electrical work station		1 : 1
D.	***Tools and Equipments***			
1.	Screw drivers	With flat tip and insulated, split proof handle blade in set of blade size 2x60,3x80,4x1oo,6x125,8x150,10x200mm	25pcs	1:1
2	Screw drivers	With flat tip and fully insulated, handled with test lamp up to 380v.blade size 3x60mm	25pcs	1:1
3	Screw drivers	Off set with Philips tip inset of four pieces with tip no. 1,2,3,4	25pcs	1:1
4	Screw drivers	With Philips tip and insulated, split proof handle blade in set of blade size and length of 100,125,200mm	25pcs	1:1
5	variable power supply	Single phase or three phase	25pcs	1:5
7	soldering iron/gun de-soldering tools	220V,50Hrz,25,40,60 W 220v,50Hrz,100W 220v,50Hrz,200W	25Pcs	1:1
9	multi-testers (analog/digital	DC voltage range 0.2,20,200,500v AC voltage range 7.5,25,75,230,750v DC current range 0.2,5,10,30Am AC current range 2,20,200Am	25pcs	1:5

		Ohmmeter 200Ohm,2K ohm,200K ohm,20M ohm		
10	electric blower	Standard	5PCS	1:5
11	Offset screwdrivers	Set	5PC	1:5
13	Magnetic pickup tools	Standard	25Pc	1:1
14	ESD system		5Pc	1:5
15	Flashlight	Standard	5Pc	1:5
16	Pliers	Combinational set	5Pc	1:5
17	Screwdrivers	Set	5Pc	1:5
18	Toner vacuum cleaner	Standard	5Pc	1:5
19	Inspection mirrors	Standard	5Pc	1:5
20	Chip extractor	Standard	5Pc	1:5
21	Spring hooks	25W	5Pc	1:5
22	Soldering iron	40/60	25Pc	1:1
23	Wire stripper	standard	5Pc	1:5
24	Electric tape	Standard	5Pc	1:5
25	Compressed cans of air	Standard	5	1:5

LEARNING MODULE 06
TVET-PROGRAMME TITLE: **Electrical/Electronic Equipment Servicing Level III**
MODULE TITLE: **Maintaining and repairing computer**
MODULE CODE: **EIS EEES3 M06 0322**
NOMINAL DURATION: .**100. Hours**
MODULE DESCRIPTION: This module covers the competence required to maintain and repair computer system. It covers the maintenance of desktop computers, laptop computers & ups.
LEARNING OUTCOMES. At the end of the module the trainee will be able to: **LO1. Plan and prepare for maintain and repair computers.** **LO2. Diagnose faults of computer systems.** **LO3**. **Rectify/correct defects in computer systems** **LO4. Maintain computer systems** **LO5. Inspect and test the computer systems**
MODULE CONTENTS: **LO1. Plan and prepare for maintain and repair computers** 1.1. Basic concepts about computer systems**.** 1.2. Follow OHS policies and procedures follow 1.3. Preparing tools, equipment and testing devices. 1.4. Planning and preparing maintenance and diagnosis of faults. **LO2. Diagnose faults of computer systems** 2.1. Using appropriate personal protective equipment**.** 2.2. Diagnosing faults or problems in the computer systems. 2.2.1 Common faults of computer systems. 2.2.2 Diagnosing flow chart. 2.3. Managing and implementing contingency measures. 2.4. Responding unexpected conditions. 2.4.1 Problem solving in emergency situation 2.4.2 Procedures in maintenance scheduling **LO3. Rectify/correct defects in computer systems** 3.1 Using appropriate personal protective equipment. 3.2 Replacing or correcting defective components or parts **LO4. Maintain computer systems**

4.1. Using appropriate personal protective equipment

4.2 Preventive maintenance of computer system and network

4.3 Checking normal function of computer systems.

4.4 Performing scheduled/periodic maintenance.

LO5. Inspect and test the computer systems

5.1. Following OHS standards and 5S principles**.**

5.2 Undertaking final inspections

5.3. Checking/testing maintain and repaired of computer.

5.4 Disposing excess components and materials.

5.4.1.Waste Electrical and Electronic Equipment (WEEE)

5.4.2 Directives and Rs Waste management program.

LEARNING METHODS:			
For None Impaired Trainees	**Reasonable Adjustment for Trainees with Disability (TWD)**		
	Deaf	**Hard of hearing**	**Physical impairment**
Lecture-discussion	❖ 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	❖ use Sign language interpreter ❖ Use video recorded material ❖ Ensure attention of the trainees ❖ Provide structured training	❖ Illustrate in clear & short method ❖ Use Video recorded material ❖ Ensure the attention of the	❖ Facilitate and support the trainees having severe upper limbs impairment to operate equipments/ machines ❖ Assign peer trainees to assist

	❖ Show clear and short method ❖ Use gesture ❖ provide tutorial support (if necessary)	trainees ❖ provide tutorial support (if necessary)	❖ Conduct close follow up ❖ Provide tutorial support (if necessary
Group discussion	❖ 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/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	❖ use sign language interpreter ❖ provide briefing /orientation on the assignment	Provide briefing /orientation on the assignment Provide visual recorded material	

	❖ provide visual recorded material		
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 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

ASSESSMENT METHODS:				
Interview		❖ Use sign language interpreter ❖ Ensure or conform whether the proper communication was conducted with the trainee through the service of the sign language interpreter ❖ Use short and clear questioning ❖ Time extension	❖ Speak loudly ❖ Using sign language interpreter if necessary	❖ Use written response as an option for the trainees having speech challenges
Written test	❖ Prepare the exam in large texts ❖ Use interview as an option if necessary ❖ Prepare the exam in audio format ❖ Assign human reader ❖ (if necessary) ❖ Time extension	❖ Prepare the exam using short sentences, multiple choices, True or False, matching and short answers ❖ Avoid essay writing ❖ Time extension	❖ Prepare the exam using short sentences, multiple choices, true or false, matching and short answers if necessary.	❖ Use oral response as an option to give answer for trainees having severe upper limb impairment ❖ Time extension for trainees having severe upper limb impairment

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

ASSESSMENT CRITERIA:

LO.1 Plan and prepare for maintain and repair computers.

- Maintenance and Diagnosis of faults are planned and prepared in line with job requirements.
- Tools, equipment and testing devices are prepared to maintain and repair of computer system.
- Necessary Materials to complete the work are obtained in accordance With established procedures and checked against job requirements.
- OHS policies and procedures are followed in line with job requirements.

LO.2 Diagnose faults of computer systems

- Appropriate personal protective equipment is used in line with standard Procedures.
- Faults or problems in the computer systems are diagnosed according to requirements and in line with the standard procedures.
- Contingency measures are managed and implemented in accordance with Established procedures.
- Unexpected conditions are responded in accordance with established procedures' unit

LO.3. Rectify/correct defects in computer systems

- Appropriate personal protective equipment is used in line with standard procedures
- Defective components or parts are replaced or corrected without damage to the surrounding environment or services.
- Adjustments, if necessary are made in accordance with established procedures

LO.4. Maintain computer systems

- Appropriate personal protective equipment is used in line with standard procedures.
- Normal function of computer systems is checked in accordance with manufacturer's instructions and guidelines.
- Scheduled/periodic maintenance is performed in accordance with manufacturer's

requirements.

- Where necessary, needed repairs/replacements are made in accordance with established procedures
- Unplanned events or conditions are responded to in accordance with established procedures

LO.5. Inspect and test the computer systems

- Final inspections are undertaken to ensure that the testing conducted on the device conforms with the manufacturer's instruction/manual
- Maintain and repaired of computer are checked/tested to ensure safe operation.
- OHS standards and 5S principles are followed according to enterprise policies
- Work site is cleaned and cleared of all debris and left in safe condition in accordance with company procedures.
- Excess components and materials are disposed of based on Waste Electrical and Electronic Equipment (WEEE) directives and 3Rs waste management program.
- Report is prepared and completed according to company requirements

EIS EEES3 M06 0322: Maintain and repair computer				
Item No.	**Category/Item**	**Description/ Specifications**	**Quantity**	**Recommended Ratio (Item: Trainee)**
A.	***Learning Materials***			
1.	.TTLM Text Books.	By trainor	5pcs	1:5
2	ECG book	Electrical and Electronics.	5pc	1:5
3	Service and maintenance manual	Volume 1,1990	5pc	1:5
B.	***Learning Facilities & Infrastructure***			
1.	Library	10 x 12 meter	1 room	1:25
2	Lecture Room	6 x 7 meter	1 room	1:25
3	Work shop	10 x 8 meter	1 room	1:25
C.	***Consumable Materials***			
1.	Drawing Papers	size of A4,A3,A1&A2	P25cs	1:1
	Pencils	HP mechanical pencil	25pcs	1:1
	Sharper		25pcs	1:1
	Eraser	Gum type eraser	25pcs	1:1
D.	***Tools and Equipments***			
1.	Soldering iron/ weller w/stand	220v/adjustable	25pcs	1:1
2.	Hot air soldering tool	220v/500degree/C	25	1:1
3.	De-soldering tools	220v/500degree/C	25	1:!
4.	screwdriver (assorted)	Set	pcs	1:1
5.	Signal generator - AF/RF	220v,150Mz	pcs	1:1
6.	Set of torks/star bit	Set	25	1:1
7.	Test jig	Standard	25	1:1

8.	Bluetooth	Standard	25	1:1
9.	Microscope	10x,50x,100x	25	1:1
10.	Assorted cable/signal connectors	Male/female	25	1:1
11.	Cotton, rugs (cotton)	5m	25	1:1
12.	Cutter	Standard set	25	1:1
13.	Magnetic coil	0.15mm^2	25	1:1
14.	Oscilloscope	150MZ	25	1:1
15.	High-grade magnifying glass with lamp	10x,50x,100x	25	1:1
16.	Flashlight	Standard	25	1:1
17.	Cleaning brush	Standard	25	1:1
18.	Cleaning agent	Standard	25	1:1
19.	Silicon grease		25	1:1
20.	Lubricants		25	1:1
21.	USB software flasher	Standard	25	1:1
22.	Rework board plate	Standard	25	1:1
23.	PC computer	220v,50Hz,HD1tera,RAM4G	25	1:1
24.	Infrared	Different	25	1:1
25.	unleaded gas	Different	25	1:1
26.	Assorted cell phone spare parts	Different type	25	1:1
27.	Soldering lead	0.8mm^2	25	1:1
28.	Wrenches (assorted)	set	5pcs	1:5
29.	Allen wrench/key	set	5pcs	1:5
30.	Multi-testers (analog/digital)	(analog/digital)	5pcs	1:5
31.	Multi-testers (analog/digital)	(analog/digital)	5pcs	1:5
32.	Clamp meter	(analog/digital)	5pcs	1:5
33.	utility knife	standard	25pcs	1:1
34.	wire stripper	standard	25pcs	1:1

35.	work bench	Wood type	25pcs	1:1
36.	flashlight and test light	standard	25pcs	1:1
37.	wires, various sizes	1.5mm^2,2.5mm^2	10role	1:1
38.	assorted electronic components	Different type	25pcs	1:1
39.	Tweezers	standard	25pcs	1:1
40.	Lap top	HD1tera,RAM4G,	5pcs	1:5
41.	Electro-static discharge (ESD)	standard	25pcs	1:1
42.	Working clothes/apron	standard	25pc	1:1
43.	Face/dust mask	standard	25pc	1:1
44.	Goggles	standard	25pc	1:1

LEARNING MODULE 07

TVET-PROGRAMME TITLE: **Electrical/Electronic Equipment Servicing III**

MODULE TITLE: **Maintain and Repair Refrigerator**

MODULE CODE: **EIS EEES3 M07 0322**

NOMINAL DURATION **: 80 Hours**

MODULE DESCRIPTION: This module covers maintain/repair components of refrigerator. It encompasses train basic principle of the refrigerant equipment; safe working practices, secure placement and connection of system components, following written and oral instruction, procedures and customer relations.

LEARNING OUTCOMES

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

LO1. Prepare to maintain/repair refrigeration unit

LO2. Diagnose faults

LO3. Maintain/repair refrigeration unit

LO4. Test repaired product

LO5. Complete work and report activities

MODULE CONTENTS:

LO1. Prepare to maintain/repair refrigeration unit

1.1. Basic concept of refrigerator system and units

1.2. identifying and implementing WHS/OHS

1.3. Identifying Tools, equipment and testing devices

1.4. Selecting components, piping, accessories, controls and consumables materials

LO2. Diagnose faults

2.1 Reading and interpreting drawings of circuit arrangements and component locations

2.2 Using tools ,equipments and test instruments

2.3 Observing pre-testing procedure

2.4 Carrying out fault diagnosis

2.5 Conducting assemble and disassemble of components and parts

2.5.1 Disassembly and disassemble of display panel

2.5.2 Disassembly and disassemble of refrigerator floodlight and freezer floodlight

2.5.3 Disassembly and disassemble of refrigerator air duct cover plate

2.5.4 Disassembly and disassemble of freezer air duct cover plate

2.5.5 Disassembly and disassemble of master control board

2.5.6 Disassembly and disassemble of hinge cover and door body

2.6 Identifying Components that require routine maintenance

2.6.1 Maintaining Refrigerant

2.6.2 Heating pipe of defroster

2.6.3 Vacuum pumping

2.6.4 Showing waste refrigerant tanker

2.6.5 Maitaining Freezer fan, Electric damper, Evaporator

2.6.6 Installing condenser coils, Compressors

2.6.7 Identifying door opening sensors, touchscreen interface

2.7 Explaining and Identified defect faults

2.7.1 Finding and rectifying fault of air conditioning systems

2.7.1.1 Symptoms and rectification of typical abnormal system

2.7.1.2 Compressor failure

2.7.1.3 Rectifying inefficient compressor and reduced pumping capacity

2.7.20 Refrigerant overcharge and undercharge

2.7.2 Explaining air distribution and cooling system

2.7.3 Techniques to determine operating values for a refrigerant, reverse cycle

2.7.4 Documenting Results of diagnosis and testing

LO3. **Maintain/repair refrigeration unit**

3.1 Using personal protective equipment

3.2 following Electro-static discharge (ESD) protection procedure

3.3 Soldering and replaced defective parts/components

3.4 Refrigerator units

3.4.1 Understanding classifications of refrigerator Based on the condenser

3.4.2 Understanding classifications of refrigerator Based on the cooling system/cooling technologies:

4.5 Techniques of Maintain/repair refrigeration unit

4.5.1 Installing cables and wiring systems

4.5.2 Maintaining/repairing process of coolant and cycle

LO4. Test repaired product

4.1 Testing functionality of repaired part/components

4.2 Final testing and reassembled units

LO5. Complete work and report activities

5.1 Cleaning worksite and equipment

5.2 Recording refrigerant usage

5.3 Complying service completion procedures and documentations

5.4 Disposing waste materials

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:

LO.1 Prepare to maintain/repair refrigeration unit

- Occupational Health & SafetyWHS/OHS risk control measures and procedures for carrying out the work are obtained and implemented in accordance with workplace procedures
- Work details are determined from documentation and/or supervisor to establish scope of work to be completed in accordance with workplace procedures
- Components, piping, accessories, controls and consumables for the installation work are obtained and checked against job requirements in accordance with industry standards and codes of practice
- Tools, equipment and testing devices to complete work are obtained in accordance with workplace procedures and checked for operational safety in accordance with workplace procedures

LO.2 Diagnose faults

- Systematic pre-testing procedure is observed in accordance with manufacturer's instructions
- Fault diagnosis is carried out in accordance with industry standards, relevant codes of practices and workplace procedures
    - ✓ Surrounding clearance
    - ✓ Surrounding ventilation
    - ✓ Disassembly of Components and Parts is conducted in accordance with the manufacturer's instruction, carried out effectively without damage to the system and components
    - ✓ Disassembly of display panel
    - ✓ Disassembly of refrigerator floodlight and freezer floodlight
    - ✓ Disassembly of refrigerator air duct cover plate
    - ✓ Disassembly of freezer air duct cover plate
    - ✓ Disassembly of master control board
    - ✓ Disassembly of hinge cover and door body
- Components that require routine maintenance are identified using appropriate tools and equipment in accordance with relevant timeframes, safety procedures, industry standards and workplace

procedures.

- Test instruments required for the job are used in accordance with user manuals
- Faults are checked and isolated using specified testing procedures
- Identified defects and faults are explained to the responsible person in accordance with enterprise or company policy and procedures
- Control settings/adjustments are checked in conformity with service-manual specifications
- Results of diagnosis and testing are documented accurately and completely within the specified time
- Customers are advised/informed regarding the status and serviceability of the unit according to company procedures

LO.3 Maintain/repair refrigeration unit

- Personal protective equipment is used in accordance with Occupational Health and Safety practices
- Electro-static discharge (ESD) protection procedure is followed in accordance with current industry standards
- Defective parts/components are replaced with identical or recommended appropriate equivalent ratings
- Repaired or replaced parts/components are soldered/mounted in accordance with the current industry standards
- Control settings/adjustments are performed in conformity with service-manual specifications
- Repair activity is performed within the required timeframe,
- System is returned to an operational state in accordance with workplace procedures and manufacturer specifications
- Test functionality of repaired part/components
- Care and extreme precaution in handling the Refrigerator units is observed as per procedures
- Cleaning of unit is performed in accordance with standard procedures

LO.4 Test repaired product

- Repaired units are reassembled according to manufacturer's specifications
- Reassembled units are subjected to final testing and cleaning in conformity with manufacturer's specifications
- Service completion procedures and documentations are complied with based on workplace requirements

- Waste materials are disposed of in accordance with environmental requirements

LO.5 Complete work and report activities

- WHS/OHS risk control measures continue to be applied in accordance with workplace procedures
- Worksite and equipment are cleaned and made safe in accordance with workplace procedures
- Refrigerant usage is recorded in accordance with relevant industry regulations and codes of practice
- Supervisor is notified of task completion in accordance with workplace procedures

Annex: Resource Requirements

EIS EEES3 M08 0322 and **Installing, maintaining/repairing air conditioning systems**				
Item No.	**Category/Item**	**Description/ Specifications**	**Quantity**	**Recommended Ratio (Item: Trainee)**
A.	***Learning Materials***			
1.	Manuals/TTLM	TTLM prepared by trainer	5	1:5
2	Reference Book			
	Practical Electronics Fault Finding and Troubleshooting	Author ROBIN PAIN	25	1:1
	Refrigeration Equipment a Servicing and Installation Handbook	Author A.C Bryant	25	1:1
	Refrigeration & Air Conditioning	Author Ahamdul Ameen	25	1:1
3	Circuit diagrams	RAC circuit diagram	5	1:5
4.	Journals/Publication/Magazines	Technology	5	1:5
B.	***Learning Facilities & Infrastructure***			
1.	Library	10mx12m	1room	1:25
2.	Class room with ramp	6mx8m	1room	1:25
3.	Work shop with ramp	10mx8m	1room	1:25
4.	work bench	Length 2m, height 80 cm, Width 1.2	5	1:5

C.	***Consumable Materials***			
1.	Insulation Tape	6-80 steel Grip, Back Colour,19mm,15mts	25	1:1
2	thermostat For Refrigerator	Defrost	25	1:1
3	Timer for refrigerator	5 legs timer	25	1:1
3	Timer for refrigerator	5 legs timer	25	1:1
4	washing machine capacitor	having four leg 12µF 1	25	1:1
5	Refrigerant	R-22	25	1:1
6	Refrigerant	R-134A	25	1:1
7	Copper lead	Copper to copper connection $2mm^2$	25	1:1
8	Otony lead bar	Copper to metal connection	25	1:1
9	Refrigerant Lamp	220v/20w	25	1:1
10	Thermal fuse	220V/5A	25	1:1
D.	***Tools and Equipment's***			
1	soldering iron/gun	40-60 Watts	25	1:1
2	screwdriver (assorted)	Philips type set	25	1:1
3	screwdriver (assorted)	Hexagonal type set	25	1:1
4	screwdriver (assorted)	Flat type set	25	1:1
5	nut drivers (assorted)	Standard set	25	1:1
6	wrenches (assorted)	Standard set	25	1:1
7	Allen wrench/key	Standard set	25	1:1
8	Multi meter	DCV 200mv-1000V± (0.5%+1) ACV 200V-75V ± (1%+4) ACV 200V-75V ± (1%+4) OHM 2000-2000KΩ±(2%+2) Continuty Beeper yes	5	1:5
9.	Clamp meter	M10ulti Function (Ampere,Voltageand Ohms)	5	1:5
10	utility knife	5 pcs replaceable blade	5	1:5
11	wire stripper	150mm length .3-4.5mm ⌀	5	1:5
12	pliers (assorted)	130mm-155mm length	5	1:5
13	flashlight and test light	Lamp indicator	5	1:5
14	cleaning brush	Outside cleaning of copper, steel, brass, aluminum tubes	5	1:5

15	ball peen hammer	300gms-500gms	5	1:5
16	cable	three in one ($2.5mm^2$)	100meter	1:25
17	Plug	220V/16A	25	1:1
18	Plug	220V/25A	25	1:1
19	soldering lead	1mm Rosein flux	5roll	1:5
20	Electric cable	3wire in one $2.5mm^2$	1 roll	1:25
21	Portable Vacuum pump	55cfm or 26 lt.Vacuum Pump. Two stage rotary vane design.Both ¼" and 3/8" SAE flare inlet connections Vacuum pump oil included	5	1:5
22	Gauge Manifold with gauge &3 charging lines	Applicable for R-22 brass body with hook, 2 hand wheel, 3pc of 60"RYB hose with ¼" flare 0-250/0-500 psi gauges.	5	1:5
23	Hammer Drill/ Normal Drill machine	3 Bits & Adapter	5	1:5
24	Nipper	6", Insulated	5	1:5
25	Spanner	(10-11)(12-13),(14-15) Drop forged chrome plated, Vanadium steel	5	1:5
26	Tape Measure	25" measuring tape pro-series measuring tape 1 inch wide, anti –shock mechanism, sturdy plastic case. Bending Point 90-94 inch	5	1:5
27	Tube Cutter	1/8" to 1-1/8" O.D. Aluminum alloy body with chrome plated finish with 1 spare cutter wheel	5	1:5
28	Metal hammer	Hard iron hammer with wooden handle & approximately weight 500gm-1Kg	5	1:5
29	Pinch off plier	Pinch off copper up to 3/8" refrigeration copper, 8" length	5	1:5
30	Ratchet Wrench	4 square opening (3/16",1/4",5/16",3/8")	5	1:5

31	Fins Straightener	6-in-1 Spacing's of 8,9,10,12,14 and 15 fins per inch	5	1:5
32	Inner outer Reamer/deburring Tools	Made of Zinc Alloy with Red color Painted Finish	5	1:5
33	Spring Bender	Sizes: 3/8"X10" Length ,1/2 "X12",5/8"X14"	5	1:5
34	Charging Lines(R-22/12/134A)	Hose rated at 2500psi Burst/500 psi Max W.P.	5	1:5
35	Digital Thermometer	-50- +200 degrees, with digital display &alarm feature	5	1:5
36	Flat File	8"/10" with Handle	5	1:5
37	Round File	6"/8" with /without handle	5	1:5
38	Allen key set	4mm,set of 9 pieces	5	1:5
39	Line Tester	Heavy Duty 440 volts	5	1:5
40	Flaring Tool Set	45" flaring, for 3/16", ¼",5/16",3/8",7/16",1/2" and 5/8"O.D.tubing self-centering yoke with swivel- type, Hardened steel, Chrome-finished flaring cone	5	1:5
41	Carpenter level/Spirit Level	Top read, 3 view, 6"/8"	5	1:5
42	Compound Gauge	150 PSI	5	1:5
43	Pressure Gauge	500 PSI or 300 PSI	5	1:5
44	Swazing Tools	5/8",1/2",3/8",1/4"	5	1:5
45	Brush for Coil cleaning	Metal wire /Soft/Paint	5	1:5
46	Copper pipe bender	½"	5	1:5
47	Copper pipe bender	3/8 "	5	1:5
48	Copper pipe bender	5/8"	5	1:5
49	Mallet Plastic Hammer	Mallet plastic/Fiber 300gm	5	1:5
50	Teflon Tape	Standard	5	1:5
51	Hacksaw	6"or 8" length of blade	5	1:5
52	Hand Gloves	Cotton industrial	5	1:5
53	Brazing Rod	2% Silver Mix	5	1:5
54	Brazing Flux	Silver Brazing Flux	5	1:5
55	Brazing Goggles	Black/Plain Glass	5	1:5
56	Brazing Torch	Light Weight brazing torch with mixer & nozzle,swirl type,oxy-DA	5	1:5

57	Air Blower	Air blower assly, can be adjusted, with speed option	5	1:5
58	Socket spanner set	Drop forged chrome plated, with Handle,24 Pieces ,Hi Tec	5	1:5
59	Cylinder N2 & O2	5Kg cylinders	5	1:5
60.	Monkey Plier	12” drop forged	5	1:5
61	Nose plier	6”, insulated	5	1:5
62	Flash back Arrester	Brass body	5	1:5
63	Piercing Valve	Tube Piercing Valve with flow control. Fits 3/16”, 1/4”,5/16’’and 3/8”OD Copper tubing connector size is1/4”S.A.E. I deal for refrigeration recovery.	5	1:5
64	Solder iron	25 w capacity	5	1:5
65	Capillary Tube cutter	Cuts all Types of Capillary Tubes without Collapsing nor Swaging the Tubes.	25	1:1
66	Hand Shut off valve	Two way valve with ¼” dia	25	1:1
67	Wire Stripper	Side cutting plier ,heavy insulated of 6”	5	1:5
68	Weighing machine	Least count 2gm to max. Capacity upto 12Kg & total weight of the machine should be around 2.5Kg.	5	1:5
69	N2,O2 &DA Cylinders	ISI marked cylinders with 5 kg or 10 Kg capacity for field &140 PSI ($7m^3$) for workshop	5	1:5
70	Fabricated Cylinder Stands	Fabricated cylinder stand with chain lock system and base with wheel’s	5	1:5
71	Refrigerant Cylinders	R-22 cylinder with 61 Kg capacity	5	1:5
72	Refrigerant Cylinders	R-22 cylinder with 5 Kg capacity	5	1:5
73	Dip Tank	4X3X2.5, MS sheet with overflow & Drain out valves	5	1:5
74	Fire Extingusher	5Kg A,B,C grade	5	1:5
75	Braded Hose(Oxygen ,Nitrogen,DA)	10-15 mts, Burst pressure 1000PSI, Heavy Duty 8mm	5	1:5

LEARNING MODULE 08
TVET-PROGRAMME TITLE: **Electrical/Electronic Equipment Servicing III**
MODULE TITLE: **Installing, maintaining/repairing air conditioning systems**
MODULE CODE: **EIS EEES3 M08 0322**
NOMINAL DURATION : **50 Hours**
MODULE DESCRIPTION : This module covers maintain/repair components of refrigerator. It encompasses train basic principle of the refrigerant equipment; safe working practices, secure placement and connection of system components, following written and oral instruction, procedures and customer relations.
LEARNING OUTCOMES At the end of the module the trainee will be able to: **LO1.** Prepare to install air conditioning systems **LO2.** Select, install and terminate low voltage (LV) and extra-low voltage (ELV) cables **LO3**. Install non-ducted split air conditioning systems **LO4.** Install ducted split air conditioning systems **LO5.** Locate and rectify faults and carry out maintenance **LO6.** Commission air conditioning systems **LO7.** Complete work and report activities
MODULE CONTENTS: **LO1. Prepare to install air conditioning systems** 1.1 Identifying basic concept of air condition 1.2 Obtaining and implementing OHS and risk control measures 1.3 Obtaining Tools, equipment and testing devices 1.4 Determining Work details 1.5 Obtaining and checking Components, piping, accessories, controls and consumables **LO2. Select, install and terminate low voltage (LV) and extra-low voltage (ELV) cables** 2.1 Selecting and terminating cables and conductors 2.2 Installing cables 2.3 Undertaking safety inspection of installed cables and testing 2.4 Documenting reasons for selections made 2.5 Documenting cables/wiring

LO3. Install non-ducted split air conditioning systems

3.1 Identifying All required major components

3.2 Installing Refrigerant pipe work and associated components

3.3 Conducting Pressure testing of the installed components and pipe

3.4 Evacuating air conditioning system

3.5 Carrying vacuum drop test

3.6 Checking power and control circuit wiring

LO4. Install ducted split air conditioning systems

5.1 Mounting major components

4.2 Installing flexible ductwork

4.3 Installing refrigerant pipework and associated components

4.4 Conducting pressure testing of the installed components and pipe

4.5 Locating and rectifying Leaks

4.6 Evacuating air conditioning system

4.7 Carrying Vacuum drop test

4.8 Checking power and control circuit wiring

LO5. Locate and rectify faults and carry out maintenance

5.1 Carrying out Fault diagnosis

5.2 Carrying fault-finding and rectification processes

5.3 Returning System

5.4 Identifying and regularizing components that require routine maintenance

LO6. Commission air conditioning systems

6.1 Charging air conditioning system

6.2 Obtaining and recording measurements

6.3 Adjusting control devices installed in the air stream

LO7. Complete work and report activities

7.1 Applying WHS/OHS risk control measures continue

7.2 Cleaning and made worksite and equipment

7.3 Recording refrigerant usage

7.4 Notifying completion of task

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	❖ Speak loudly ❖ Using sign	❖ Use written response as an option for the trainees

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

ASSESSMENT CRITERIA:

LO.1 Prepare to install air conditioning systems

- Occupational Health & Safety WHS/OHS risk control measures and procedures for carrying out the work are obtained and implemented in accordance with workplace procedures
- Work details are determined from documentation and/or supervisor to establish scope of work to be completed in accordance with workplace procedures
- Components, piping, accessories, controls and consumables for the installation work are obtained and checked against job requirements in accordance with standards and codes of practice
- Tools, equipment and testing devices to complete work are obtained in accordance with workplace procedures and checked for operational safety in accordance with workplace procedures

LO.2 Select, install and terminate low voltage (LV) and extra-low voltage (ELV) cables

- Cable conductor sizes are selected to meet the equipment manufacturer specifications, current-carrying capacity requirements and voltage-drop
- Reasons for selections made, including calculations, are documented
- Cables are installed to comply with technical standards and job specifications and requirements with sufficient access to affect terminations
- Cables and conductors are terminated at accessories
- Safety inspection of installed cables and testing of installed circuits for air conditioning system are undertaken and any defects are rectified
- Cables/wiring are documented and appropriate person/s notified

LO.3 Install non-ducted split air conditioning systems

- All required major components are securely mounted in the locations identified by the documentation or the supervisor
- Refrigerant pipe work and associated components are installed according to specifications ensuring all connections and tube cleanliness are
- Pressure testing of the installed components and pipe work is conducted to the required level for the type of refrigerant being used
- Leaks are located and rectified employing appropriate methods

- Air conditioning system is evacuated to remove moisture and other contaminates
- Vacuum drop test is carried out to verify all moisture and other contaminants have been removed from the system
- Power and control circuit wiring is checked to ensure it conforms to circuit diagram specifications and system is electrically safe to energize

LO.4 Install ducted split air conditioning systems

- Major components are securely mounted in the locations identified by the documentation or the supervisor in accordance with workplace procedures
- Flexible ductwork, associated fittings and flow control devices are installed according to specifications
- Refrigerant pipe work and associated components are installed ensuring all connections and tube cleanliness is maintained at all times in accordance with workplace procedures and manufacturer specifications
- Pressure testing of the installed components and pipe work is conducted to the required level for the type of refrigerant being used
- Leaks are located and rectified employing appropriate methods in accordance with industry standards and codes of practices
- Air conditioning system is evacuated to remove moisture and other contaminates in accordance with industry standards, relevant codes of practices and workplace procedures
- Vacuum drop test is carried out to verify all moisture and other contaminants have been removed from the system
- Power and control circuit wiring is checked to ensure it conforms to circuit diagram specifications and system

LO.5 Locate and rectify faults and carry out maintenance

- Fault diagnosis is carried out using appropriate tools and equipment in accordance with industry standards, relevant codes of practices and workplace procedures
- Fault-finding and rectification processes are carried out effectively without damage to the system and components in accordance with relevant codes of practice, industry standards and workplace procedures

- System is returned to an operational state in accordance with workplace procedures and manufacturer specifications
- Components that require routine maintenance are identified and regularly maintained in accordance with relevant timeframes, industry standards and workplace procedures.
    - System is returned to an operational state in accordance with workplace procedures and manufacturer specifications
    - Components that require routine maintenance are identified and regularly maintained in accordance with relevant timeframes, industry standards and workplace procedures

LO.6 Commission air conditioning systems

- Air conditioning system is charged with the appropriate type and quantity of refrigerant in accordance with industry standards, relevant codes of practices and workplace procedures
- Measurements are obtained and recorded to confirm that the refrigerant charge is optimal in accordance with the system's design and manufacturer specifications
- Control devices installed in the air stream for air flow quantity and distribution control are adjusted in accordance with the system's design and manufacturer specifications
- 6Measurements are obtained and recorded to confirm that air flow quantities and distribution is optimal in accordance with the system's design and manufacturer specifications

LO.7 Complete work and report activities

- WHS/OHS risk control measures continue to be applied in accordance with workplace procedures
- Worksite and equipment are cleaned and made safe in accordance with workplace procedures
- Refrigerant usage is recorded in accordance with relevant industry regulations and codes of practice
- Supervisor is notified of task completion in accordance with workplace procedures

Annex: Resource Requirements

EIS EEES3 M08 0322 and **Installing, maintaining/repairing air conditioning systems**				
Item No.	**Category/Item**	**Description/ Specifications**	**Quantity**	**Recommended Ratio (Item: Trainee)**
A.	***Learning Materials***			
1.	Manuals/TTLM	prepared by trainer	5	1:5
2	Reference Book			
3	Practical Electronics Fault Finding and Troubleshooting	Author ROBIN PAIN	5	1:5
	Refrigeration Equipment Servicing and Installation Handbook	Author A.C Bryant	5	1:5
	Refrigeration & Air Conditioning	Author Ahamdul Ameen	5	1:5
3	Circuit diagrams	RAC circuit diagram	5	1:5
4.	Journals/Publication/Magazines	Technology	5	1:5
B.	***Learning Facilities & Infrastructure***			
1.	Lecture room	6mx8m	1	1:25
2.	Demonstration room	10mx15m	1	1:25
3.	Lecture room	10mx15m	1	1:25
4.	work bench	Length 2m, height 80 cm, Width 1.2	5	1:5
C.	***Consumable Materials***			
1.	Insulation Tape	6-80 steel Grip, Back Colour,19mm,15mts	25	1:1
2	thermostat For Refrigerator	Defrost	25	1:1
3	Timer for refrigerator	5 legs timer	25	1:1
3	Timer for refrigerator	5 legs timer	25	1:1
4	washing machine capacitor	having four leg 12µF 1	25	1:1
5	Refrigerant	R-22	25	1:1

6	Refrigerant	R-134A	25	1:1
7	Copper lead	Copper to copper connection $2mm^2$	25	1:1
8	Otony lead bar	Copper to metal connection	25	1:1
9	Refrigerant Lamp	220v/20w	25	1:1
10	Thermal fuse	220V/5A	25	1:1
D.	***Tools and Equipment's***			
1	soldering iron/gun	40-60 Watts	25	1:1
2	screwdriver (assorted)	Philips type Set	25	1:1
3	screwdriver (assorted)	Hexagonal type set	25	1:1
4	screwdriver (assorted)	Flat type set	25	1:1
5	nut drivers (assorted)	Standard	25	1:1
6	wrenches (assorted)	Standard set	25	1:1
7	Allen wrench/key	Standard set	25	1:1
8	Multi meter	DCV 200mv-1000V± (0.5%+1) ACV 200V-75V ± (1%+4) ACV 200V-75V ± (1%+4) OHM 2000-2000KΩ±(2%+2) Continuty Beeper yes	5	1:5
9.	Clamp meter	M10ulti Function (Ampere,Voltageand Ohms)	5	1:5
10	utility knife	5 pcs replaceable blade	5	1:5
11	wire stripper	150mm length .3-4.5mm ø	5	1:5
12	pliers (assorted)	130mm-155mm length	5	1:5
13	flashlight and test light	Lamp indicator	5	1:5
14	cleaning brush	Outside cleaning of copper, steel, brass, aluminum tubes	5	1:5
15	ball peen hammer	300gms-500gms	5	1:5
16	cable	three in one ($2.5mm^2$)	100meter	1:25
17	Plug	220V/16A	25	1:1
18	Plug	220V/25A	25	1:1
19	soldering lead	1mm Rosein flux	5roll	1:5
20	Electric cable	3wire in one $2.5mm^2$	1 roll	1:25
21	Portable Vacuum pump	55cfm or 26 lt.Vacuum Pump.	5	1:5

		Two stage rotary vane design.Both ¼" and 3/8" SAE flare inlet connections Vacuum pump oil included		
22	Gauge Manifold with gauge &3 charging lines	Applicable for R-22 brass body with hook, 2 hand wheel, 3pc of 60"RYB hose with ¼" flare 0-250/0-500 psi gauges.	5	1:5
23	Hammer Drill/ Normal Drill machine	3 Bits & Adapter	5	1:5
24	Nipper	6", Insulated	5	1:5
25	Spanner	(10-11)(12-13),(14-15) Drop forged chrome plated, Vanadium steel	5	1:5
26	Tape Measure	25" measuring tape pro-series measuring tape 1 inch wide, anti –shock mechanism, sturdy plastic case. Bending Point 90-94 inch	5	1:5
27	Tube Cutter	1/8" to 1-1/8" O.D. Aluminum alloy body with chrome plated finish with 1 spare cutter wheel	5	1:5
28	Metal hammer	Hard iron hammer with wooden handle & approximately weight 500gm-1Kg	5	1:5
29	Pinch off plier	Pinch off copper up to 3/8" refrigeration copper, 8" length	5	1:5
30	Ratchet Wrench	4 square opening (3/16",1/4",5/16",3/8")	5	1:5
31	Fins Straightener	6-in-1 Spacing's of 8,9,10,12,14 and 15 fins per inch	5	1:5
32	Inner outer Reamer/deburring Tools	Made of Zinc Alloy with Red color Painted Finish	5	1:5
33	Spring Bender	Sizes: 3/8"X10" Length ,1/2	5	1:5

		“X12”,5/8”X14”		
34	Charging Lines(R-22/12/134A)	Hose rated at 2500psi Burst/500 psi Max W.P.	5	1:5
35	Digital Thermometer	-50- +200 degrees, with digital display &alarm feature	5	1:5
36	Flat File	8”/10” with Handle	5	1:5
37	Round File	6”/8” with /without handle	5	1:5
38	Allen key set	4mm,set of 9 pieces	5	1:5
39	Line Tester	Heavy Duty 440 volts	5	1:5
40	Flaring Tool Set	45” flaring, for 3/16”, ¼”,5/16”,3/8”,7/16”,1/2” and 5/8”O.D.tubing self-centering yoke with swivel- type, Hardened steel, Chrome-finished flaring cone	5	1:5
41	Carpenter level/Spirit Level	Top read, 3 view, 6”/8”	5	1:5
42	Compound Gauge	150 PSI	5	1:5
43	Pressure Gauge	500 PSI or 300 PSI	5	1:5
44	Swazing Tools	5/8”,1/2”,3/8”,1/4”	5	1:5
45	Brush for Coil cleaning	Metal wire /Soft/Paint	5	1:5
46	Copper pipe bender	½”	5	1:5
47	Copper pipe bender	3/8 ”	5	1:5
48	Copper pipe bender	5/8”	5	1:5
49	Mallet Plastic Hammer	Mallet plastic/Fiber 300gm	5	1:5
50	Teflon Tape	Standard	5	1:5
51	Hacksaw	6”or 8” length of blade	5	1:5
52	Hand Gloves	Cotton industrial	5	1:5
53	Brazing Rod	2% Silver Mix	5	1:5
54	Brazing Flux	Silver Brazing Flux	5	1:5
55	Brazing Goggles	Black/Plain Glass	5	1:5
56	Brazing Torch	Light Weight brazing torch with mixer & nozzle,swirl type,oxy-DA	5	1:5
57	Air Blower	Air blower assly, can be adjusted, with speed option	5	1:5
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73	Dip Tank	4X3X2.5, MS sheet with overflow & Drain out valves	5	1:5
74	Fire Extingusher	5Kg A,B,C grade	5	1:5
75	Braded Hose(Oxygen ,Nitrogen,DA)	10-15 mts, Burst pressure 1000PSI, Heavy Duty 8mm	5	1:5

Acknowledgement

The **Ministry of Labor and Skills** wishes to thank and appreciation for the trainers who donated their effort and time to develop this outcome based curriculum for the TVET program

Electrical/Electronic Equipment Servicing Level III. We also thank all regional TVET College trainers and A.A twoun administration TVET College for active facilitation of their trainers for the development of this cur

The trainers who developed the curriculum

No	Name	Qualification	Educational background	Region	College	Mobile number	E-mail
1.	Mesfin Cheru Abebe	MSc	BED. In Elect.Techo	A.A	World together Ethiopia	091141933	Mesfincheruofworldtogther.0r.kk.
2.	Tesfahun Ayalew Denidine	MSc	Electronics and comm Eng.	BGRS	Assosa poly TVET	0912132308	tesfugps44@gmial.com
3.	Ayano Assefa Mekebo	MSc	Electrical power	SNNP	Arbaminch sat. instu.	0920062670	assefahule@gmial.com
4.	Wubishut temesgen Jaleta	MSc	Electrical &comm.T	Sidama	Hawassa poly TVET	0910040962	Wubepg2@gaimale.com
5.	Yohannis fetene Dassalgn	MSc	Electrical & comm.T	ANRS	Kombolcha Poly TVET	0991642905	Yohannesfetene1@gmail.com
6.	Yidelkachew Regassa Hirpa	MSc	Electrical & comm.T	Harari	Harari poly TEVET Co	0910343909	Yidne888@gmail.com