Competency Based Curriculum (CBC)

Solar Electrical System Installation and Maintenance

Level-2

Light Engineering Sector

Curriculum Code:CBC-LE-SESIM-L2-EN-V1

National Skills Development Authority
Chief Adviser's Office
Government of the People's Republic of Bangladesh

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The curriculum is designed based on NSDA approved **Solar Electrical System Installation and Maintenance, Level – 2,** Occupation Competency Standards. It covers the information required to implement the **Solar Electrical System Installation and Maintenance, Level - 2** standard. It is an important supporting document for trainers, assessors and curriculum developers.

This document has been developed by NSDA with the support of ISC representatives'/industry representatives from relevant sectors, academia, curriculum specialists, expert trainers and professionals.

All Government-Private-NGO training institutes of the country recognized by NSDA can use this curriculum to implement skill-based training of **Solar Electrical System Installation and Maintenance, Level –2** course.

Introduction

The importance of skill-based training in socio-economic development of the country is immense. Demand oriented training is an important area for increasing productivity, creating employment and alleviating poverty. Skill development training institutes established at public and private level in Bangladesh are providing skill development training commercially. It is important to have uniform training curriculum based on occupation to improve and harmonize the overall quality of training conducted in all these training institutions. NSDA as provided in the National Skill Development Authority Act, 2018 is formulating uniform curriculum for training programs conducted across the country in various occupations/trades.

Competency standards for various occupations (level based) are being formulated by NSDA with the aim of creating skilled manpower as per the demand of domestic and international labor market.

Skilled and trained trainers are essential for providing training and assessment according to competency standards. For this purpose, the curriculum of **Solar Electrical System Installation and Maintenance, Level -2** has been formulated through an expert committee consisting of ISC/Industry representatives from respective sectors, academia, curriculum specialists, expert trainers and professionals. This curriculum includes essential course design, course structure, course delivery methods, equipment and facilities inventory, and physical facilities. Apart from this, the assessment criteria of trainees, assessment procedure, qualification level and certification process have been inserted.

This curriculum is an NSDA-approved document that describes the overall contents of the training implementation of **Solar Electrical System Installation and Maintenance, Level –2** as per industry demand-based competency standards. The trainees of **Solar Electrical System Installation and Maintenance, Level –2** course can develop themselves as skilled and qualified **Solar Electrician** by following properly.

Competency Based Learning Materials (CBLM) and Assessment tools are developed following this document. Assessment and certification of trainees will also follow this curriculum.

List of Abbreviations

CS	Competency Standard
ISC	Industry Skills Council
NSDA	National Skills Development Authority
BNQF	Bangladesh National Qualifications Framework
OSH	Occupational Safety and Health
SCVC	Standards and Curriculum Validation Committee
STP	Skills Training Provider
SOP	Standard Operating Procedure
UoC	Unit of Competency
ISO	International Organization for Standardization
OSH	Occupational Safety and Health
PPE	Personal Protective Equipment
SOP	Standard Operating Procedures

Table of Content

Course Design

Name of Course: Solar Electrical System Installation and Maintenance

Skill Level : National Skills Certificate(NSC)-2

Nominal Hours : 270 Hours

List of Unit of Competency

Generic Unit of Competency

1 Carryout Workplace Interaction
2 Work in a Self-Directed Team

Sector Specific Unit of Competency

Occupation Specific Unit of Competency

1 Interpret On-Grid, Hybrid, Solar Irrigation and Energy Storage System
2 Prepare Site Assessment Report for On-Grid, Hybrid and Solar Irrigation System
3 Interpret Design, Drawing and Specifications for On-Grid, Hybrid and Solar Irrigation System
4 Use Hand and Power Tools in On-Grid, Hybrid and Solar Irrigation System
5 Install On-Grid, Hybrid and Solar Irrigation System
6 Troubleshoot and Maintain On-Grid, Hybrid and Solar Irrigation System

Description of Course

It is a skill-based training course designed to develop the knowledge, skills and workplace attitude required for the Solar Electrical System Installation and Maintenance in Light Engineering Sector. The curriculum covers various skills such as, Carryout Workplace Interaction, Work in a Self-Directed Team, Interpret On-Grid, Hybrid, Solar Irrigation and Energy Storage System, Prepare Site Assessment Report for On-Grid, Hybrid and Solar Irrigation System, Interpret Design, Drawing and Specifications for On-Grid, Hybrid and Solar Irrigation System, Use Hand and Power Tools in On-Grid, Hybrid and Solar Irrigation System, Install On-Grid, Hybrid and Solar Irrigation System and Troubleshoot and Maintain On-Grid, Hybrid and Solar Irrigation System

Learning Outcome of the Course

Successful completion of this course will lead to certification in **Solar Electrical System Installation and Maintenance**, Level-2 under the Bangladesh National Qualification Framework (BNQF). Also, the course has the following functional, economic, and social learning outcomes.

Work Oriented Learning Outcome

1. Can work effectively as a **Technician**
2. Carryout Workplace Interaction

Financial Learning Outcome

1. Job opportunities will be created as **Technician** in country and abroad.
2. Can contribute to socio-economic development by participating in skill development activities

Social Learning Outcome

1. Social status will increase by achieving personal development
2. The share of skilled human resources will increase in line with changing technology
3. The number of skilled and trained **Technician** will increase in the society

Course Structure

Generic Unit of Competency - 30Hrs.

Sl. No.	Unit of Competency	Module Title	Learning Outcome	Nominal Hours
1	Carryout Workplace Interaction	Carrying out Workplace Interaction	1. Interpret workplace communication and etiquette 2. Read and understand workplace documents 3. Participate in workplace meetings and discussions 4. Practice professional ethics at workplace	15
2	Work in a Self-Directed Team	Working in a Self-Directed Team	1. Identify team goals and processes 2. Communicate and cooperate with team members 3. Work as a team member 4. Solve problems as a team member	15

Sector Specific Unit of Competency – 00 Hrs.

Occupation Specific Unit of Competency–240 Hours

Sl. No.	Unit of Competency	Module Title	Learning Outcome	Nominal Hours
1.	Interpret On-Grid, Hybrid, Solar Irrigation and Energy Storage System	Interpreting On-Grid, Hybrid, Solar Irrigation and Energy Storage System	1. Interpret On-grid/ grid tied System 2. Interpret hybrid System 3. Interpret solar irrigation system 4. Interpret energy storage system 5. Interpret grid connectivity and net-metering	20
2.	Prepare Site Assessment Report for On-Grid, Hybrid and Solar Irrigation System	Preparing Site Assessment Report for On-Grid, Hybrid and Solar Irrigation System	1. Conduct site inspection and collect data 2. Identify potential challenges and constraints 3. Prepare and document the site assessment report	20
3.	Interpret Design, Drawing and Specifications for On-Grid, Hybrid and Solar Irrigation System	Interpreting Design, Drawing and Specifications for On-Grid, Hybrid and Solar Irrigation System	1. Identify signs, symbols and specifications in the layout drawing 2. Interpret layout drawings 3. Apply freehand layout sketching.	40
4.	Use Hand and Power Tools in On-Grid, Hybrid and Solar Irrigation System	Using Hand and Power Tools in On-Grid, Hybrid and Solar Irrigation System	1. Select hand tools and power tools 2. Practice to use hand tools and power tools 3. Maintain hand tools and power tools	30
5	Install On-Grid, Hybrid and Solar Irrigation System	Installing On-Grid, Hybrid and Solar Irrigation System	1 Identify solar system components 2 Locate and prepare place 3 Handle components 4 Install Module Mounting Structure (MMS) 5 Install Solar Module. 6 Install Components	80
6	Troubleshoot and Maintain On-Grid, Hybrid and Solar Irrigation System	Troubleshooting and Maintaining On-Grid, Hybrid and Solar Irrigation System	1 Prepare for work. 2 Perform routine maintenance 3 Diagnose faults in SES units and wiring 4 Repair the faults in SES unit and wiring 5 Clean and store tools and equipment	50
			Total Hours	**240**

Analysis of Competency

Generic Unit of Competency	Number of Module
1. Carryout Workplace Interaction	01
2. Work in a Self-Directed Team	01
Sector SpecificUnit of Competency	
Occupation SpecificUnit of Competency	
3. Interpret On-Grid, Hybrid, Solar Irrigation and Energy Storage System	01
4. Prepare Site Assessment Report for On-Grid, Hybrid and Solar Irrigation System	01
5. Interpret Design, Drawing and Specifications for On-Grid, Hybrid and Solar Irrigation System	01
6. Use Hand and Power Tools in On-Grid, Hybrid and Solar Irrigation System	01
7. Install On-Grid, Hybrid and Solar Irrigation System	01
8. Troubleshoot and Maintain On-Grid, Hybrid and Solar Irrigation System	01
Total	**08**

Course Delivery

1. Face to Face
2. Self Paced Learning
3. On the job
4. Off the job
5. Blended

Course Training Method

A variety of methods can be applied to course training depending on the students' learning interests and abilities. Instructors should select appropriate methods to train students. Some of the common methods used during skills training are:

1. Lecture
2. Presentation
3. Discussion
4. Demonstration
5. Guided Practice
6. Individual Pactice
7. Project Work
8. Problem Solving
9. Brainstorming

Module of Instruction

- Generic
- Sector Specific and
- Occupation Specific

Generic Modules

Unit of Competency	**Carryout Workplace Interaction**
Unit Code	**GU-03-L2-V1**
Module Title	Carrying out Workplace Interaction
Module Descriptor	This unit covers the knowledge, skills and attitude required to carry out workplace interaction. It specifically includes interpreting workplace communication and etiquette, reading and understanding workplace documents, participating in workplace meetings and discussions and practicing professional ethics at workplace.
Nominal Hours	**15 Hours**
Learning Outcome	After completing the practice of the module, the trainees will be able to perform the following jobs: 1. Interpret workplace communication and etiquette 2. Read and understand workplace documents 3. Participate in workplace meetings and discussions 4. Practice professional ethics at workplace

Learning Outcome -1: Interpret workplace communication and etiquette	
Assessment Criteria	1. Workplace code of conducts is interpreted as per organizational guidelines 2. Appropriate lines of communication are maintained with supervisors and colleagues 3. Workplace interactions are conducted in a courteous manner to gather and convey information 4. Questions about routine workplace procedures and matters are asked and responded as required
Conditions and Resources	• Workplace or Simulated Workplace • Workplace code of conducts • CBLM • Handout • Multimedia Projector • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker
Contents	1. Workplace code of conducts 2. courteous manner 2.1 Effective questioning 2.2 Active listening 2.3 Speaking skills 3. Workplace procedures and matters 3.1 Notes 3.2 Agenda 3.3 Simple reports 3.3.1 Progress report 3.3.2 Incident report 3.4 Job sheets 3.5 Operational manuals 3.6 Brochures and promotional material 3.7 Visual and graphic materials 3.8 Standards 3.9 OSH information 3.10 Signs
Job/ Task/ Activity	1. Interpret workplace code of conducts 2. Demonstate line communication with supervisors and colleagues 3. Demonstate courteous manner to gather and convey information

Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -2: Read and understand workplace documents	
Assessment Criteria	1. Workplace documents are interpreted as per standard. 2. Assistance is taken to aid comprehension when required from peers / supervisors 3. Visual information / symbols / signage's are understood and followed 4. Specific and relevant information are accessed from appropriate sources 5. Appropriate medium is used to transfer information and ideas
Conditions and Resources	• Workplace or Simulated Workplace • Workplace documents • Visual information / symbols / signage's • CBLM • Handout • Multimedia Projector • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker
Contents	1 Workplace documents 2 Visual information / symbols / signage's 3 Appropriate sources 3.1 HR Department 3.2 Managers 3.3 Supervisors
Job/ Task/ Activity	1. Interpret workplace documents 2. Identify visual information / symbols / signage's 3. Identify appropriate sources for relevant information
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -3: Participate in workplace meetings and discussions	
Assessment Criteria	1. Team meetings are attended on time and meeting procedures and etiquette are followed 2. Own opinions are expressed and others opinions are listened without interruption 3. Inputs are provided consistent with meeting purpose and meeting outcomes are implemented
Conditions and Resources	• Workplace or Simulated Workplace • CBLM • Handout • Multimedia Projector • Paper, Pen, Pencil and Eraser • Internet Facilities
Contents	1 Meeting procedures and etiquette 2 Implementation technique of meeting outcomes
Job/ Task/ Activity	1. Practice etiquette and manner 2. Implement meeting outcomes
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -4: Practice professional ethics at workplace	
Assessment Criteria	1. Responsibilities as a team member are demonstrated and kept promises and commitments made to others 2. Tasks are performed in accordance with workplace procedures 3. Confidentiality is respected and maintained 4. Situations and actions considered inappropriate or which present a conflict of interest are avoided
Conditions and Resources	• Workplace or Simulated Workplace • Responsibilities as a team member • Conflict of interest • CBLM • Handout • Multimedia Projector • Paper, Pen, Pencil and Eraser • Internet Facilities
Contents	1 Responsibilities as a team member 2 Confidentiality of workplace 3 Conflict of interest
Job/ Task/ Activity	1. Interpret responsibilities as a team member 2. Interpret conflict of interest
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Unit of Competency	**Work in a Self-Directed Team**
Unit Code	**GU-04-L3-V1**
Module Title	**Working in a Self-Directed Team**
Module Descriptor	This unit covered the knowledge, skills and attitude to communicate and work within a team in an interactive work environment as per the workplace standard.
Nominal Hours	**15 Hours**
Lerning Outcome	After completing the practice of the module, the trainees will be able to perform the following jobs: 1. Identify team goals and processes 2. Communicate and cooperate with team members 3. Work as a team member 4. Solve problems as a team member

Learning Outcome -1: Identify team goals and processes	
Assessment Criteria	1. Team goals and processes are identified. 2. Roles and responsibilities of team members are identified. 3. Relationships within team and with other work areas are identified.
Conditions and Resources	• Workplace or Simulated Workplace • Team goal • Roles and responsibilities of team members • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	1. Team goal 1.1 Identifying the problem 1.2 Consider solutions 1.3 Action 1.4 Follow-up. 2. Roles and responsibilities of team members
Job/ Task/ Activity	1. Identify team goal 2. Identify roles and responsibilities of team members 3. Identify relationships within team and with other work areas

Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -2: Communicate and cooperate with team members	
Assessment Criteria	1. Effective interpersonal skills are used to interact with team members and to contribute to activities and objectives. 2. Formal and informal forms of communication are used effectively to support team achievement. 3. Diversity is respected and valued in team functioning. 4. Views and opinions of other team members are understood and reflected accurately. 5. Workplace staff regulation is used correctly to assist communication.
Conditions and Resources	• Workplace or Simulated Workplace • Interpersonal skills • Formal and informal forms of communication • Workplace staff regulation • CBLM • Handout • Multimedia Projector • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	1. Effective interpersonal skills 2. Formal and informal forms of communication 3. Diversity in team functioning 4. Workplace staff regulation 4.1 Organization / company's code of conduct, complaint handling / grievance policies and procedures

Job/ Task/ Activity	1. Demonstate use of effective interpersonal skills to interact with team members 2. Demonstate use of formal and informal forms of communication to support team achievement 3. Interpret workplace staff regulation
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -3: **Work as a team member**	
Assessment Criteria	1. Duties, responsibilities, authorities, objectives and task requirements are identified and clarified with team. 2. Tasks are performed in accordance with organizational and team requirements, specifications and workplace procedures. 3. Team members support other members as required to ensure team achieves goals and requirements. 4. Agreed reporting lines are followed using standard operating procedures
Conditions and Resources	• Workplace or Simulated Workplace • Duties, responsibilities of team member • CBLM • Handout • Paper, Pen, Pencil, • Internet Facilities • White Board and marker
Contents	1. Duties, responsibilities of team member
Job/ Task/ Activity	1. Identify duties, responsibilities of team member
Training Method	• Discussion • Presentation • Demonstration

	• Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -4: **Solve problems as a team member**	
Assessment Criteria	1. Current and potential problems faced by team are identified. 2. Procedures for avoiding and managing problems are identified. 3. Problems are solved effectively and in a manner that supports the team.
Conditions and Resources	• Workplace or Simulated Workplace • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker
Contents	1. Procedures for avoiding and managing problems
Job/ Task/ Activity	1. Identify problem 2. Interpret avoiding and managing problems
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Sector Specific Module

Occupation Specific Module

Unit of Competency	**Interpret On-Grid, Hybrid, Solar Irrigation and Energy Storage System**
Unit Code	**OU-LE- SESIM -01-L2-V1**
Module Title	Interpreting On-Grid, Hybrid, Solar Irrigation and Energy Storage System
Module Descriptor	This unit covers the knowledge, skills and attitudes required to interpret On-grid, hybrid, solar irrigation and energy storage system It specifically includes – interpret On-grid/grid tied system, hybrid system, solar irrigation system, energy storage system and grid connectivity and net metering.
Nominal Hours	**20 Hours**
Learning Outcome	After completing the practice of the module, the trainees will be able to perform the following jobs: 1. Interpret On-grid/ grid tied System 2. Interpret hybrid System 3. Interpret solar irrigation system 4. Interpret energy storage system 5. Interpret grid connectivity and net-metering

Learning Outcome -1: Interpret On-Grid/ Grid Tied System	
Assessment Criteria	1. On-grid system is interpreted. 2. On-grid system is identified. 3. Difference between On-grid and Off grid system is interpreted.
Conditions and Resources	• Workplace or Simulated Workplace • On-grid/ grid tied system • CBLM • Handout • Paper, Pen, Pencil and Eraser • White Board and marker
Contents	1. On-grid/ grid tied system 2. Components of on-grid/ grid tied system
Job/ Task/ Activity	1. Interpret on-grid/ grid tied system 2. Identify on-grid/ grid tied system
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -2: Interpret Hybrid System	
Assessment Criteria	1. Hybrid system is interpreted. 2. Hybrid system is identified. 3. Difference among the systems is interpreted.
Conditions and Resources	• Workplace or Simulated Workplace • Hybrid solar system • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device

Contents	1. System 1.1. Off Grid, 1.2. On-Gid, 1.3. Hybrid, 1.4. Energy Storage system 1.5. Cleaning process and system
Job/ Task/ Activity	1. List the solar system 2. Identify hybrid system 3. Interpret hybrid system
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -3: Interpret solar irrigation system	
Assessment Criteria	1. Solar irrigation system is interpreted. 2. Solar irrigation system is identified.
Conditions and Resources	• Workplace or Simulated Workplace • Solar irrigation system • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	1. Solar irrigation system 2. Components of Solar irrigation system
Job/ Task/ Activity	1. Interpret solar irrigation system 2. Identify components of solar irrigation system
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -4: Interpret energy storage system	
Assessment Criteria	1. Energy storage system is interpreted. 2. Energy storage system is identified.
Conditions and Resources	• Workplace or Simulated Workplace • Energy storage system • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	1. Energy storage system 2. Function of Energy storage system
Job/ Task/ Activity	1. Identify Energy storage system 2. Identify components of Energy storage system 3. Interpret the function of Energy storage system
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -5: Interpret Grid connectivity and Net Energy metering	
Assessment Criteria	1. Grid connectivity requirements are identified. 2. Connections of net energy metering system is interpreted; 3. Net metering policy is interpreted.
Conditions and Resources	• Workplace or Simulated Workplace • Grid connectivity and Net Energy metering • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	1. Grid connectivity system 2. Net Energy metering system 3. Policy of Net Energy metering
Job/ Task/ Activity	1. Identify Grid connectivity requirements 2. Interpret Net metering policy
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Unit of Competency	**Prepare Site Assessment Report for On-Grid, Hybrid and Solar Irrigation System**
Unit Code	**OU-LE-SESIM-02-L2-V1**
Module Title	Preparing Site Assessment Report for On-Grid, Hybrid and Solar Irrigation System
Module Descriptor	This unit of competency requires the knowledge, skills and attitude to prepare site assessment report for on-grid, hybrid and solar irrigation system. It specially includes the tasks -conduct site inspection and collect data, identify potential challenges and constraints and prepare and document site assessment report.
Nominal Hours	**20 Hours**
Learning Outcome	After completing the practice of the module, the trainees will be able to perform the following jobs: 1. Conduct site inspection and collect data 2. Identify potential challenges and constraints 3. Prepare and document the site assessment report

Learning Outcome -1: Conduct site inspection and collect data	
Assessment Criteria	1. Site inspection is conducted following occupational safety and health standards. 2. Relevant site data is collected as required. 3. Site and Environmental conditions are verified and recorded. 4. Evacuation point is evaluated 5. Cable route is identified;
Conditions and Resources	• Workplace or Simulated Workplace • Checklist for data collection • CBLM • Handout • Paper, Pen, Pencil and Eraser • White Board and marker
Contents	1 Occupational Safety and Health (OSH) standard for site inspection 2 Relevant site data 2.1 Available area for PV Module installation 2.2 Sun light exposure facing (Azimuth) 2.3 Obstacles 2.4 Roof access and quality of roof 2.5 Water quality, level and demand for irrigation 3 Site and Environmental conditions 3.1 Dust 3.2 Salinity 3.3 Nearest of Forest 3.4 Cable route
Job/ Task/ Activity	1. Collect relevant site data 2. Verfy and record site and environmental conditions 3. Identify cable route
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -2: Identify potential challenges and constraints	
Assessment Criteria	1. Potential shading issues and site-specific obstructions are identified; 2. Structural integrity of installation surfaces is evaluated. 3. Placement for components are identified; 4. Weather conditions and potential hazards are evaluated;
Conditions and Resources	• Workplace or Simulated Workplace • Challenges and constraints • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker
Contents	1. Assessment and considerations: 1.1 Potential shading issues 1.2 Site-specific obstructions 1.3 Structural integrity 1.4 Placement for components 1.5 Weather conditions 1.6 Potential hazards
Job/ Task/ Activity	1. Identify potential shading issues 2. Identify site-specific obstructions 3. Identify placement for component 4. Evaluate weather conditions and potential hazards
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -3: Prepare and document the site assessment report	
Assessment Criteria	1. Site data is consolidated 2. Challenges, risks, and mitigation strategies are documented. 3. Site specific compliance is addressed. 4. Site assessment report including recommendations is prepared.
Conditions and Resources	• Workplace or Simulated Workplace • Site specific compliance • CBLM • Handout • Paper, Pen, Pencil and Eraser • White Board and marker
Contents	1. Procedure of consolidate data 2. Challenges, risks, and mitigation strategies 3. Site specific compliance
Job/ Task/ Activity	1. Consolidate site data 2. Identify challenges, risks and mitigation strategies 3. Preparen site assessment report
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Unit of Competency	**Interpret Design, Drawing and Specifications for On-Grid, Hybrid and Solar Irrigation System**
Unit Code	**OU-LE-SESIM-03-L2-V1**
Module Title	Interpreting Design, Drawing and Specifications for On-Grid, Hybrid and Solar Irrigation System
Module Descriptor	This unit covers the knowledge, skills and attitudes required to interpret design, drawing and specifications for on-grid, hybrid and solar irrigation system It specifically includes – Identify signs, symbols and specifications in the layout drawings, interpret layout drawings and apply freehand sketching.
Nominal Hours	**40 Hours**
Learning Outcome	After completing the practice of the module, the trainees will be able to perform the following jobs: 1. Identify signs, symbols and specifications in the layout drawing 2. Interpret layout drawings 3. Apply freehand layout sketching.

Learning Outcome -1: Identify signs, symbols and specifications in the layout drawing	
Assessment Criteria	1. Layout drawing of the selected work plan is collected. 2. Signs, symbols and specifications are identified. 3. Signs, symbols and specifications are checked against job requirement
Conditions and Resources	• Workplace or Simulated Workplace • Chart of signs, symbols and specifications • Occupation related drawing and specification • CBLM • Handout • Paper, Pen, Pencil and Eraser • White Board and marker
Contents	1 Layout drawings 1.1 Electrical single line diagram (SLD) 1.2 Solar mounting structure drawing 1.3 Wiring diagram 2 Chart of signs and symbols 3 Checking procedure of signs, symbols and specifications against job requirements
Job/ Task/ Activity	1. Select layout drawing 2. Identify signs, symbols and specifications 3. Check signs, symbols and specifications against job requirements
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -2: Interpret layout drawings	
Assessment Criteria	1. Layout drawing is interpreted. 2. Placement of components is identified in layout drawings. 3. Tools and equipment is identified, 4. Components, assemblies and materials are listed. 5. Dimensions of SES equipment with electrical accessories are identified. 6. Specifications are matched with available resources and job requirements.
Conditions and Resources	• Workplace or Simulated Workplace • Layout drawing • Tools and equipments • Components, assemblies and materials • CBLM • Handout • Paper, Pen, Pencil and Eraser • White Board and marker
Contents	1. Layout drawing 2. Tools and equipments 3. Components, assemblies and materials 3.1 PV Module 3.2 Charge controller 3.3 Battery 3.4 Inverter 3.5 Light fixtures 3.6 Switch board 3.7 Switch gear and protection equipment 3.7.1 Surge Protector 3.7.2 Lighting arrester 3.7.3 Earthing 3.7.4 AC and DC switches 3.7.5 Breakers /Fuses 4. Electrical combiner boxes 5. Electrical cables and wires 5.1 DC cable 5.2 AC cable
Job/ Task/ Activity	1. Interpret layout drawing 2. Identify tools and equipments 3. Prepare list of components, assemblies and materials 4. Identify dimension of SES equipments 5. Match specifications with job requirements

Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -3: Apply freehand layout sketching.	
Assessment Criteria	1. Freehand sketching is applied where applicable in accordance with the job requirements. 2. The drawing is adjusted to the specifications.
Conditions and Resources	• Workplace or Simulated Workplace • Drawing and specifications • Freehand sketch • CBLM • Handout • Paper, Pen, Pencil and Eraser • White Board and marker
Contents	1. Layout drawing 2. Freehand sketch
Job/ Task/ Activity	1. Draw a freehand sketch wiring diagram for assigned work
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Unit of Competency	**Use Hand Tools and Power Tools in On-Grid, Hybrid and Solar Irrigation System**
Unit Code	**OU-LE-SESIM-04-L2-V1**
Module Title	Using Hand Tools and Power Tools in On-Grid, Hybrid and Solar Irrigation System
Module Descriptor	This unit covers the knowledge, skills and attitudes required to use hand and power tools in on-grid, hybrid and solar irrigation system It specifically includes - select hand tools and power tools, practice to use hand tools and power tools and maintain hand tools and power tools
Nominal Hours	**30 Hours**
Learning Outcome	After completing the practice of the module, the trainees will be able to perform the following jobs: 1. Select hand tools and power tools 2. Practice to use hand tools and power tools 3. Maintain hand tools and power tools

Learning Outcome -1: Select hand tools and power tools	
Assessment Criteria	1. Appropriate hand tools and power tools are selected as per requirement of the task. 2. Usages of hand tools and power tools are interpreted. 3. Unsafe or defective hand tools and power tools are identified and marked
Conditions and Resources	• Workplace or Simulated Workplace • Hand tools • Power tools • CBLM • Handout • Paper, Pen, Pencil and Eraser • White Board and marker

Contents	1 Selection of hand tools 1.1 Screw drivers 1.2 Diagonal cutting pliers 1.3 Cable cutter 1.4 Long nose pliers 1.5 Combination pliers 1.6 Adjustable wrenches 1.7 Socket wrench set 1.8 Torque wrench 1.9 Hand punch 1.10 Neon tester 1.11 Battery tester 1.12 Allen key 1.13 Ferrule printer/ punch 1.14 Crimping tool 1.15 Spanner set 1.16 Touch light 1.17 Electrician knife 2 Selection of power tools 2.1 Hydraulic punch 2.2 Cordless drill machine 2.3 Electric hammer drill 2.4 Heat gun 2.5 Impact wrench 3 Tasks 3.1 Adjusting 3.2 Assembling 3.3 Straitening / flattening 3.4 Finishing items or components 3.5 Clamping 3.6 Marking and tagging
Job/ Task/ Activity	1. Identify hand tools as per task 2. Identify power tools as per task
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test

	• Demonstration • Oral questioning • Portfolio

Learning Outcome -2: Practice to use hand tools and power tools	
Assessment Criteria	1. Hand and power tools are used to perform the job as per specification. 2. Safe work practices are followed while using hand and power tools in the work environment. 3. Proper mind and body concentration is maintained during work.
Conditions and Resources	• Workplace or Simulated Workplace • Hand tools • Power tools • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker
Contents	1. Selection criteria of hand tools as per job requirements 2. Selection criteria of power tools as per job requirements 3. Safe practices rules for use hand tools and power tools
Job/ Task/ Activity	1. Use hand tools as per SOP 2. Use power tools as per SOP
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -3: Maintain hand tools and power tools	
Assessment Criteria	1. Routine maintenance of hand and power tools is undertaken according to standard operating procedures 2. Hand and power tools are stored in designated location in accordance with SOP of the company 3. Workplace is cleaned and waste are disposed as per workplace standards.
Conditions and Resources	• Workplace or Simulated Workplace • Hand tools • Power tools • Service manual • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	1. Routine maintenance 1.1. Cleaning 1.2. Lubricating 1.3. Tightening 1.4. Calibration and tunning 2. Hand tools and power tools maintaining procedure
Job/ Task/ Activity	1. Perform routine maintenance of hand and power tools 2. Store hand tools and power tools as per workplace standard
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Unit of Competency	**Install On-Grid, Hybrid and Solar Irrigation System**
Unit Code	**OU-LE-SESIM-05-L2-V1**
Module Title	Installing On-Grid, Hybrid and Solar Irrigation System
Module Descriptor	This unit of competency requires the knowledge, skills and attitude required to install on-grid, hybrid and solar irrigation system. It specifically includes the tasks of identifying SES components, locating and preparing place, handling components, installing mounting structures, the solar panel and components
Nominal Hours	**80 Hours**
Learning Outcome	After completing the practice of the module, the trainees will be able to perform the following jobs: 1. Identify solar system components 2. Locate and prepare place 3. Handle components 4. Install Module Mounting Structure (MMS) 5. Install Solar Module. 6. Install Components

Learning Outcome -1: Identify solar system components	
Assessment Criteria	1. Personal protective equipment (PPE) is used 2. Special rope, safety belts and ladder are used while working at site. 3. Solar system components are identified and collected.
Conditions and Resources	• Workplace or Simulated Workplace • PPE • Solar system components • CBLM • Handout • Paper, Pen, Pencil and Eraser • White Board and marker
Contents	1 OSH guide line 2 Use of PPE 3 Solar system components 3.1 PV Module 3.2 Module Mounting Structure (MMS) 3.3 Inverter (On-Grid, Hybrid) 3.4 Charge Controller (Hybrid system) 3.5 Battery for hybrid system (Lead Acid, Li-ion, LiFePO4) 3.6 Battery Rack 3.7 Cable (AC and DC) 3.8 Cable Conduit 3.9 Communication Cable 3.10 Online monitoring system 3.11 Pump for Solar irrigation system 3.12 Pump Controller for Solar irrigation system
Job/ Task/ Activity	1. Select PPE 2. Select and identify solar system components
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -2: Locate and prepare places	
Assessment Criteria	1. Appropriate place with maximum sunlight exposure for mounting solar PV Module. 2. Obstacle against the sunlight is identified and taken into consideration.
Conditions and Resources	• Workplace or Simulated Workplace • Solar panel • Panel mounting • Tools and equipment • CBLM • Handout • Paper, Pen, Pencil and Eraser • White Board and marker
Contents	1. Appropriate place 1.1 Roof top with maximum sunlight exposure 1.2 Additional place at the top of Pole
Job/ Task/ Activity	1. Select and prepare place for PV Module installation
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -3: Handle components	
Assessment Criteria	1. Components are collected as per requirement 2. Components are handled as per user guide
Conditions and Resources	• Workplace or Simulated Workplace • Solar panel • Panel mounting • Tools and equipment • Major component and accessories • CBLM • Handout • White Board and marker
Contents	1. Solar components list 2. Solar components handling procedure
Job/ Task/ Activity	1. Prepare solar components lists as per requirements 2. Handle PV module as per user guide
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -4: Install Module Mounting Structures (MMS)	
Assessment Criteria	1. Module Mounting Structure is selected and collected 2. Module Mounting Structure is erected with required tilt angle; 3. Base of MMS is measured and construction condition is checked as per standard;
Conditions and Resources	• Workplace or Simulated Workplace • Solar panel • Module Mounting Structure • Tools and equipment • Major component and accessories • CBLM • Handout • White Board and marker
Contents	1. Mounting structure 1.1 Design of the mounting structure from 15 to 25 degree between the adjacent arms (As per sample). 1.2 Size of the mounting structure to be adjusted with the Solar Panel.
Job/ Task/ Activity	1. Erect PV module mounting structure as per standard 2. Set PV module on mounting structure
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -5: Install the PV module	
Assessment Criteria	1. PV modules are selected and collected 2. PV modules are fixed with MMS as per standard;
Conditions and Resources	• Workplace or Simulated Workplace • Tools and equipment • Module mounting structures • PV module • CBLM • Handout • White Board and marker
Contents	1. Selection and collection procedure of PV modules 2. PV modules fixing procedure with MMS as per standard
Job/ Task/ Activity	1. Select and collect PV modules 2. Fix PV modules with MMS as per standard
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -6: Install Components	
Assessment Criteria	1. Components are selected and collected 2. Components are installed as per standard
Conditions and Resources	• Workplace or Simulated Workplace • Tools and equipment • Solar components • CBLM • Handout • White Board and marker
Contents	1. Selection and collection procedure of solar components 2. Installation procedure of solar components as per standard
Job/ Task/ Activity	1. Select and collect solar components 2. Install solar components as per standard
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Unit of Competency	**Troubleshoot and Maintain On-Grid, Hybrid and Solar Irrigation System**
Unit Code	**OU-LE-SESIM-06-L2-V1**
Module Title	Troubleshooting and Maintaining On-Grid, Hybrid and Solar Irrigation System
Module Descriptor	This unit of competency covers the knowledge, skills and attitude required to troubleshoot and maintain on-grid, hybrid and solar irrigation system. It specially includes the tasks of performing routine maintenance, diagnose faults in SES units and wiring and repaired the faults in SES unit and wiring.
Nominal Hours	**50 Hours**
Learning Outcome	After completing the practice of the module, the trainees will be able to perform the following jobs: 1. Prepare for work. 2. Perform routine maintenance 3. Diagnose faults in SES units and wiring 4. Repair the faults in SES unit and wiring 5. Clean and store tools and equipment

Learning Outcome -1: Prepare for work	
Assessment Criteria	1. Safe work environment is observed and corrective action is taken. 2. Personal Protective Equipment (PPE) is worn as per job requirement. 3. Schedule for maintenance is collected and interpreted
Conditions and Resources	• Workplace or Simulated Workplace • PPE • Maintenance schedule • CBLM • Handout • Paper, Pen, Pencil and Eraser • White Board and marker
Contents	1 OSH guide line 2 PPE 2.1 Apron 2.2 Hand gloves 2.3 Face mask 2.4 Safety shoes 2.5 Goggles 2.6 Safety helmet 2.7 Harness 2.8 Maintenance schedule
Job/ Task/ Activity	1. Maintain safe work environment 2. Interpret maintenance schedule
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -2: Perform routine maintenance	
Assessment Criteria	1. PV module is cleaned as per schedule. 2. Quality of water for cleaning system is checked. 3. Connection terminal is checked as per schedule. 4. Inverter is cleaned as per schedule. 5. Parameters of battery are checked as per schedule, if battery is available in Solar electrical system
Conditions and Resources	• Workplace or Simulated Workplace • Solar electrical system material and accessories • Tools and equipment • CBLM • Handout • Paper, Pen, Pencil and Eraser • White Board and marker • Audio video device
Contents	1. Schedule for maintenance 2. Routine maintenance schedule: 2.1 PV module 2.2 Terminal connections 2.2.1 Terminal connection of switches, sockets, light fixtures 2.2.2 Terminal connection of PV 2.2.3 Terminal connection of charge controller 2.2.4 Terminal connection of inverter 2.2.5 Terminal connection of battery 2.2.6 Switchgear and protection equipment incoming and outgoing points 2.2.7 Connection of solar motor 2.3 Inverter 2.4 Battery parameter 2.4.1 Water level 2.4.2 Specific gravity 2.4.3 Open circuit voltage
Job/ Task/ Activity	1. Carryout routine maintenance of: 1.1 PV module 1.2 Terminal connections 1.3 Inverter 1.4 Battery parameters

Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -3: Diagnose faults in SES units and wiring	
Assessment Criteria	1. Physical faults in the major components are checked visually. 2. Operational faults in the major components are checked by testing instruments. 3. Panel and string are tested for appropriate functioning. 4. Fault code is identified and reported to the supervisor
Conditions and Resources	• Workplace or Simulated Workplace • Solar panel • Panel mounting • Tools and equipment • Major component and accessories • CBLM • Handout • White Board and marker
Contents	1. Physical faults 1.1. Broken and crack PV module 1.2. Burnt components by high temperature 1.3. Damaged by insect 1.4. Circuit disconnection due to vibration 1.5. Lose connection 1.6. Battery terminal broken 1.7. Lose screw 2. Major components 2.1. Solar panel (PV module) 2.2. Charge controller 2.3. Battery 2.4. Inverter 3. Operational faults 3.1. Components are inactive by aging 3.2. Components are inactive by transient effect 3.3. Components are inactive due to manufacturing defects 3.4. Components are inactive due to overload 3.5. Components are inactive due to short circuit 4. Testing instruments 4.1. Multimeter 4.2. LASER thermometer 4.3. Clamp on meter 4.4. Hydrometer
Job/ Task/ Activity	1. Check visually physical faults of SES unit 2. Check operational faults by testing instruments.

Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -3: Repair the faults of SES unit and wiring	
Assessment Criteria	1. Battery water is added. 2. Loose connections are repaired throughout the wiring. 3. Faulty components are replaced as per supervisor instruction.
Conditions and Resources	• Workplace or Simulated Workplace • Solar panel • Panel mounting • Tools and equipment • Major component and accessories • CBLM • Handout • Computer/Laptop • Multimedia Projector • Internet Facilities • White Board and marker
Contents	1.3 Procedure of repair faults of SES unit
Job/ Task/ Activity	3. Repair/replace faulty components of SES unit after testing;
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -5: Clean and store tools and equipment	
Assessment Criteria	1. Tools and equipment are cleaned. 2. Tool, measuring instrument and excess materials are stored as per workplace procedure. 3. Wastages are disposed as per workplace requirement.
Conditions and Resources	• Workplace or Simulated Workplace • Tools and equipment • CBLM • Handout • White Board and marker
Contents	1. Cleaning and storing procedure of tools and equipment. 2. Wastage disposal procedure;
Job/ Task/ Activity	3. Demonstate cleaning and storing of tools and equipment
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Competency based curriculum (CBC)

The CBC is also termed as Competency Based Curriculum and is developed based on NCS and labour market needs.

CBT curricula are designed considering the following principles.

- Identification of competencies in consultation with experts from industries and training institutes
- Adopting 21st century pedagogy and methodology
- Training must be in line with labour market need and industrial standard
- Creating training modality to experience real working situation through platform such as OJT and Industrial visit

What is Competency-Based Curriculum (CBC)

- A competency-based curriculum is a framework or guide for the subsequent detailed development of competencies, associated methodologies, training and assessment resources.

- The CBC specifies the outcomes which are consistent with the requirements of the workplace as agreed through the industry or community consultations.

- CBC can be developed immediately when competency standards exist.

- When competency standards do not exist, curriculum developers need to clearly define the learning outcomes to be attained. The standard of performance required must be appropriate to industry and occupational needs through the industry/enterprise or specified client group consultations.

Validation of Competency Based Curriculum

The Competency Based Curriculum for National Skills Certificate in Solar Electrical System Installation and Maintenance; Level-02 is validated by NSDA on 31 July 2025.

List of Members

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