Competency Based Curriculum (CBC)

Solar Electrical System Installation and Maintenance

Level-1

Light Engineering Sector

Curriculum Code:CBC-LE-SESIM-L1-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 – 1,** Occupation Competency Standards. It covers the information required to implement the **Solar Electrical System Installation and Maintenance, Level - 1** 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 –1** 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 -1** 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 –1** as per industry demand-based competency standards. The trainees of **Solar Electrical System Installation and Maintenance, Level –1** course can develop themselves as skilled and qualified **Assistant 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
PPE	Personal Protective Equipment
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)-1

Nominal Hours : 360 Hours

List of Unit of Competency

Generic Unit of Competency

1 Perform Computations Using Basic Mathematical Concepts
2 Apply Occupational Safety and Health (OSH) Procedure in the Workplace

Sector Specific Unit of Competency

Occupation Specific Unit of Competency

1 Interpret the concept of climate change, renewable energy and solar electrical energy
2 Apply Basic Concepts of Electricity and Electrical Circuits
3 Estimate Load for Installation of Off-Grid System
4 Interpret Drawing and Specifications for Off-Grid System
5 Use Hand tools and Power Tools in Off-Grid System
6 Install Off-Grid SES and Solar Street Light
7 Perform Wiring for Off-Grid SES and Solar Street Light
8 Troubleshoot and Maintain of Off Grid Solar 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, perform computations using basic mathematical concepts, apply occupational safety and health (osh) procedure in the workplace, interpret the concept of climate change, renewable energy and solar electrical energy, use hand and power tools in solar electrical system, interpret drawing and specifications for solar electrical system, estimate load for installation of off-grid system, apply basic concepts of electrical circuits, perform wiring for ses, install ses, install solar based street light and off grid system and maintain and troubleshoot of off grid solar system

Learning Outcome of the Course

Successful completion of this course will lead to certification in **Solar Electrical System Installation and Maintenance**, Level-1 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 **Junior Technician**
2. Occupational Safety and Health Regulations (OSH) may apply

Financial Learning Outcome

1. Job opportunities will be created as **Junior 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 **Junior 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	Perform Computations Using Basic Mathematical Concepts	Performing Computations Using Basic Mathematical Concepts	1. Identify calculation requirements in the workplace 2. Select appropriate mathematical methods for the calculation. 3. Use tool/instrument to perform calculations	15
2	Apply Occupational Safety and Health (OSH) Procedure in the Workplace	Applying Occupational Safety and Health (OSH) Procedure in the Workplace	1. Identify OSH policies and procedures 2. Follow OSH procedures 3. Report hazards and risks 4. Respond to emergencies 5. Maintain personal well-being	15

Sector Specific Unit of Competency – 00 Hrs.

Occupation Specific Unit of Competency–330 Hours

Sl. No.	Unit of Competency	Module Title	Learning Outcome	Nominal Hours
1.	Interpret the Concept of Climate Change, Renewable Energy and Solar Energy	Interpreting the Concept of Climate Change, Renewable Energy and Solar Energy	1. Interpret climate change and its impact. 2. Interpret the role of renewable energy in climate change 3. Interpret concept of Solar Electrical System (SES) 4. Identify workplace requirements in SES	20
2.	Apply Basic Concepts of Electricity and Electrical Circuits	Applying Basic Concepts of Electricity and Electrical Circuits	1. Interpret the principle of electricity generation 2. Interpret electric parameters and measurement procedure 3. Interpret electric circuits 4. Perform electrical wiring. 5. Clean and store tools and equipment	40
3.	Estimate Load for Installation of Off-Grid System	Estimating Load for Installation of Off-Grid System	1. Calculate electrical load 2. Perform measurement 3. Select off-grid system size.	20
4.	Interpret Drawing and Specifications for Off-Grid System	Interpreting Drawing and Specifications for Off-Grid System	1. Identify signs, symbols and specifications in the layout drawing 2. Interpret layout drawings 3. Apply freehand sketching.	50
5	Use Hand tools and Power Tools in Off-Grid System	Using Hand tools and Power Tools in Off-Grid System	1 Select hand tools and power tools 2 Practice to use hand and power tools 3 Maintain hand and power tools	30
6	Install Off-Grid SES and Solar Street Light	Installing Off-Grid SES and Solar Street Light	1 Identify SES components 2 Locate and prepare place 3 Handle components 4 Set the solar panel 5 Install components	80

7	Perform Wiring for Off-Grid SES and Solar Street Light	Performing Wiring for Off-Grid SES and Solar Street Light	1 Identify the route of conduits wiring. 2 Estimate the materials 3 Lay the conduit 4 Install wiring	50
8	Maintain and Troubleshoot of Off Grid Solar System	Maintaining and Troubleshoot of Off Grid Solar 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	**330**

Analysis of Competency

Generic Unit of Competency	Number of Module
1. Perform Computations Using Basic Mathematical Concepts	01
2. Apply Occupational Safety and Health (OSH) Procedure in the Workplace	01
Sector SpecificUnit of Competency	
Occupation SpecificUnit of Competency	
3. Interpret the concept of climate change, renewable energy and solar electrical energy	01
4. Apply Basic Concepts of Electricity and Electrical Circuits	01
5. Estimate Load for Installation of Off-Grid System	01
6. Interpret Drawing and Specifications for Off-Grid System	01
7. Use Hand tools and Power Tools in Off-Grid System	01
8. Install Off-Grid SES and Solar Street Light	01
9. Perform Wiring for Off-Grid SES and Solar Street Light	01
10. Troubleshoot and Maintain of Off Grid Solar System	01
Total	**10**

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	**Perform Computations Using Basic Mathematical Concepts**
Unit Code	**GU-01-L2-V1**
Module Title	Performing Computations Using Basic Mathematical Concepts
Module Descriptor	This unit covers the knowledge, skills and attitudes required to perform computations using basic mathematical concepts It specifically includes the tasks of identifying calculation requirements in the workplace, selecting appropriate mathematical methods for the calculation and selecting tool/instrument to perform calculations.
Nominal Hours	**15 Hours**
Learning Outcome	After completing the practice of the module, the trainees will be able to perform the following jobs: 1. Identify calculation requirements in the workplace 2. Select appropriate mathematical methods for the calculation. 3. Use tool/instrument to perform calculations

Learning Outcome -1: Identify calculation requirements in the workplace	
Assessment Criteria	1. Job requirements are identified 2. Measurements are selected in accordance with job requirement 3. Calculation requirements are identified from workplace information
Conditions and Resources	• Workplace or Simulated Workplace • CBLM • Handout • Job Order • Drawing and design • Instructions • Multimedia Projector • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker
Contents	1. Measurements 1.1 Length 1.2 Width 1.3 Weight 1.4 Tolerance 2. Units of measurements 3. Workplace information 3.1 Job Order 3.2 Design 3.3 Working drawing 3.4 Instruction
Job/ Task/ Activity	1. Identify units of measuremenmt 2. Measure leanth, width and weight 3. Identify data from workplace information
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning

Learning Outcome -2: Select appropriate mathematical methods for the calculation	
Assessment Criteria	1. Mathematical methods are identified 2. Appropriate method is selected to carry out the calculation requirements 3. Tolerance and clearance limits are identified and adjusted according to the job requirements
Conditions and Resources	• Workplace or Simulated Workplace • CBLM • Handout • Multimedia Projector • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker
Contents	1 Appropriate mathematical methods 1.1 Addition 1.2 Subtraction 1.3 Division 1.4 Multiplication 1.5 Conversion 1.6 Percentage and ratio calculation
Job/ Task/ Activity	1. Carry out mathematical calculations 2. Identify and adjust tolerance
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning

Learning Outcome -3: Use tool/instrument to perform calculations	
Assessment Criteria	1. Work instructions are confirmed and applied to the job in hand 2. Materials to be measured are identified as per job specification 3. Appropriate tool/ instrument is selected based on materials to be measured
Conditions and Resources	• Workplace or Simulated Workplace • CBLM • Handout • Multimedia Projector • Paper, Pen, Pencil and Eraser • Internet Facilities • Appropriate tool/ instrument for calculation
Contents	1 Tools/Instrument 1.1 Calculator 1.2 Scale 1.3 Measuring tape 1.4 Marker 2 Work instructions Addition 3 Appropriate tool/ instrument selection technique
Job/ Task/ Activity	1. Identify materials to be measured 2. Use tools/instrument for measurement
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning

Unit of Competency	**Apply Occupational Safety and Health (OSH) Procedure in the Workplace**
Unit Code	**GU-02-L1-V1**
Module Title	**Applying Occupational Safety and Health (OSH) Procedure in the Workplace**
Module Descriptor	This module covers the knowledge, skills and attitudes required to apply occupational safety and health (OSH) procedure in the workplace. It specifically includes identifying OSH policies and procedures, following OSH procedures, reporting hazards and risks, responding to emergencies, and maintaining personal well-being.
Nominal Hours	**15Hours**
Lerning Outcome	After completing the practice of the module, the trainees will be able to perform the following jobs: 1. Identify OSH policies and procedures 2. Follow OSH procedures 3. Report hazards and risks 4. Respond to emergencies 5. Maintain personal well-being
Learning Outcome -1: Identify OSH policies and procedures	
Assessment Criteria	1. OSH policies and safe operating procedures are accessed and stated 2. Safety signs and symbols are identified and followed 3. Emergency response, evacuation procedures and other
Conditions and Resources	• Workplace or Simulated Workplace • Materials and equipment for OSH • Safety sign and symbols • OSH policies • CBLM • Handout • Multimedia Projector • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	1. OSH policies 2. Safe operating procedures 3. Safety signs and symbols 4. Emergency response, evacuation procedures and other contingency measures
Job/ Task/ Activity	1. State occupational safety and health policy 2. Identify safety signs and symbols

Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	1. Written Test 2. Demonstration 3. Oral questioning

Learning Outcome -2: Follow OSH procedures	
Assessment Criteria	1. Personal protective equipment (PPE) is selected and collected as required 2. Personal protective equipment (PPE) is correctly used in accordance with organization OSH procedures and practices 3. A clear and tidy workplace is maintained as per workplace standard 4. PPE is maintained to keep them operational and compliant with OSH regulations
Conditions and Resources	• Workplace or Simulated Workplace • Necessary PPE • CBLM • Handout • Multimedia Projector • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	1. Personal Protective Equipment (PPE) 2. OSH procedures and practices 3. Clear and tidy workplace 4. Maintainence of PPE
Job/ Task/ Activity	1. Select, collect and use personal protective equipment (PPE) 2. Perform cleaning and make tidy your workplace 3. Maintain Personal Protective Equipment (PPE)

Training Method	1. Discussion 2. Presentation 3. Demonstration 4. Guided Practice 5. Individual Practice 6. Project Work 7. Problem Solving 8. Brainstorming
Assessment Method	1. Written Test 2. Demonstration 3. Oral questioning

Learning Outcome -3: **Report Hazards and Risks**	
Assessment Criteria	1. Hazards and risks are identified, assessed and controlled 2. Incidents arising from hazards and risks are reported to designated authority
Conditions and Resources	• Workplace or Simulated Workplace • CBLM • Handout • Multimedia Projector • Paper, Pen, Pencil, • Internet Facilities • White Board and marker • Necessary PPE
Contents	1. Identifying, assessing and controllinghazards and risks 2. Incidents arising from hazards and risks
Job/ Task/ Activity	1. Identify and assess hazards and risks 2. Report incidents arising from hazards and risks to appropriate authorities
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	1. Written Test 2. Demonstration 3. Oral questioning

Learning Outcome -4: **Respond to Emergencies**	
Assessment Criteria	1. Alarms and warning devices are responded 2. Workplace emergency procedures are followed 3. Contingency measures during workplace accidents, fire and other emergencies are recognized and followed in accordance with organization procedures 4. Frist aid procedures is applied during emergency situations
Conditions and Resources	• Workplace or Simulated Workplace • CBLM • Handout • Multimedia Projector • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device • Necessary tools • Necessary PPE
Contents	1. Alarms and warning devices andworkplace emergency procedures 2. Contingency measures during workplace accidents, fire and other emergencies 3. Frist aid procedures
Job/ Task/ Activity	1. Follow the signals of alarm and warning devices 2. Determine contingency management during workplace accidents, fires and other emergencies 3. Administer first aid
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	1. Written Test 2. Demonstration 3. Oral questioning

Learning Outcome -5: **Maintain Personal Well-being**	
Assessment Criteria	1. OSH policies and procedures are adhered OSH awareness programs are participated as per workplace guidelines and procedures 2. Corrective actions are implemented to correct unsafe condition in the workplace 3. "Fit to work" records are updated and maintained according to workplace requirements
Conditions and Resources	• Workplace or Simulated Workplace • CBLM • Handout • Computer/Laptop • Multimedia Projector • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	1. OSH policies and procedures 2. OSH awareness programs 3. Corrective actions for unsafe condition 4. "Fit to work" records
Job/ Task/ Activity	1. Identify Occupational Safety and Health policies and procedures 2. Identify and apply corrective actions to correct unsafe conditions 3. Maintain "Fit for work" record
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 the Concept of Climate Change, Renewable Energy and Solar Electrical Energy**
Unit Code	**OU-LE- SESIM -01-L1-V1**
Module Title	Interpreting the Concept of Climate Change, Renewable Energy and Solar Electrical Energy
Module Descriptor	This unit covers the knowledge, skills and attitudes required to interpreting climate change and its impact, the role of renewable energy in climate change, concept of Solar Electrical System (SES) and identifying workplace requirements in SES
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 climate change and its impact. 2. Interpret the role of renewable energy in climate change 3. Interpret concept of Solar Electrical System (SES) 4. Identify workplace requirements in SES

Learning Outcome -1: Interpret climate change and its impact.	
Assessment Criteria	1. Concept of climate change is interpreted 2. Causes of climate change are listed 3. Global warming issues are identified 4. Adverse effect of climate change is interpreted
Conditions and Resources	• Workplace or Simulated Workplace • CBLM • Handout • Multimedia Projector • Paper, Pen, Pencil and Eraser • White Board and marker
Contents	1. Cause of climate change 1.1 Global warming due to CO_2 and other gas emission 1.2 Fuel burning 1.3 Deforestation 1.4 Gas emission related to greenhouse effect 2. Adverse effect. 2.1 Cyclone 2.2 Flood/Tidal surges. 2.3 Drought. 2.4 Salinity. 2.5 Crop failure 2.6 River errotion. 3. Impact of climate change
Job/ Task/ Activity	1. Interpret: • climate change and its impact • adverse effect of climate change
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 the role of renewable energy in climate change	
Assessment Criteria	1. Renewable energy sources are identified 2. Prospect of renewable energy is interpreted 3. Mitigation of climate change through renewal energy is comprehended
Conditions and Resources	• Workplace or Simulated Workplace • CBLM • Handout • Multimedia Projector • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	1. Renewable energy 1.1. Solar 1.2. Wind power 1.3. Biogas 1.4. Hydropower 1.5. Biofuel 1.6. Geothermal
Job/ Task/ Activity	1. List the renewable energy source
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 concept of Solar Electrical System (SES)	
Assessment Criteria	1. Solar electrical system is interpreted 2. Trends and solar electrical technologies relevant to SES is interpreted 3. Solar Electrical relevant policies and guidelines are identified and interpreted
Conditions and Resources	• Workplace or Simulated Workplace • CBLM • Handout • Multimedia Projector • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	1. Solar electrical systems 1.1 On grid 1.2 Off grid 2. Solar Electrical relevant policies and guidelines
Job/ Task/ Activity	1. Interpret On grid and off grid system 2. Identify and interpret solar electrical relevant policies and guidelines
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: Identify workplace requirements in SES	
Assessment Criteria	1. Workplace requirements are identified. 2. Roles and responsibilities of all personnel working in Solar Electrical System (SES) are interpreted 3. Work schedule in Solar Electrical System workplace is interpreted 4. Requirements of safety signs, symbols and banners in workplace is interpreted
Conditions and Resources	• Workplace or Simulated Workplace • Safety signs, symbols and banners • CBLM • Handout • Multimedia Projector • Paper, Pen, Pencil and Eraser • White Board and marker
Contents	1. Workplace requirements 1.1 Timely attendance 1.2 Working in SES service as per company requirements 1.3 Maintaining daily working hours 1.4 Work in installation of solar home system, street light, off grid, grid connected and hybrid system 1.5 Work in installation of solar pump, on grid or grid connected and power plant system 1.6 Work in trouble shooting of SES 2. Roles and responsibilities of all personnel working in Solar Electrical System (SES) 3. Work schedule in Solar Electrical System workplace. 4. Requirements of safety signs, symbols and banners in workplace
Job/ Task/ Activity	1. Identify workplace requirements. 2. Interpret roles and responsibilities of all personnel working in Solar Electrical System (SES) 3. Interpret work schedule in Solar Electrical System workplace 4. Identify safety signs, symbols and banners in workplace
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	**Apply Basic Concepts of Electricity and Electrical Circuits**
Unit Code	**OU-LE-SESIM-02-L1-V1**
Module Title	Applying Basic Concepts of Electricity and Electrical Circuits
Module Descriptor	This unit covers the knowledge, skills and attitudes required to apply basic concepts of electricity and electrical circuits It specially includes the tasks - interpret the principle of electricity generation, electric parameters and measurement procedure, electric circuits and perform electrical wiring.
Nominal Hours	**40 Hours**
Learning Outcome	After completing the practice of the module, the trainees will be able to perform the following jobs: 1. Interpret the principle of electricity generation 2. Interpret electric parameters and measurement procedure 3. Interpret electric circuits 4. Perform electrical wiring 5. Clean and store tools and equipment

Learning Outcome -1: Interpret the principle of electricity generation	
Assessment Criteria	1. Occupational Safety and Health (OSH) standard for electrical works are interpreted 2. Electricity generation process by generator and solar panel is interpreted; 3. Renewable and non-renewable energy sources are identified; 4. Working principle of conversion of solar energy to electrical energy is interpreted; 5. Solar energy storage principle is interpreted;
Conditions and Resources	• Workplace or Simulated Workplace • Generator • Solar panel • Renewable and non-renewable energy sources • Measuring instrument • CBLM • Handout • Paper, Pen, Pencil and Eraser • White Board and marker
Contents	1 Occupational Safety and Health (OSH) standard for electrical works. 2 Electricity generation process by generator and solar panel 3 Renewable and non-renewable energy sources 3.1 Renewable 3.1.1 Solar energy 3.1.2 Hydro energy 3.1.3 Wind energy 3.1.4 Bio energy 3.1.5 Nuclear energy 3.2 Non-renewable energy 3.2.1 Petroleum based energy 3.2.2 Coal based energy 3.3 Working principle of conversion of solar energy to electrical energy 3.4 Solar energy storage principle
Job/ Task/ Activity	1. Identify Occupational Safety and Health (OSH) standard for electrical works 2. Interpret electricity generation process by generator and solar panel 3. Identify renewable and non-renewable energy sources 4. Interpret working principle of conversion of solar energy to electrical energy 5. Interpret solar energy storage principle

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 electric parameters and measurement procedure	
Assessment Criteria	1. Electrical conductor, semi-conductor and insulator is identified. 2. Sources of electricity are interpreted 3. Nature of electricity is interpreted; 4. Difference between AC and DC is explained 5. Electrical measuring units are described. 6. Measurement of voltage, current and resistance with measuring instrument are demonstrated. 7. Power and energy of a particular load is explained.
Conditions and Resources	• Workplace or Simulated Workplace • Electrical conductor, semi-conductor and insulator • Measuring instrument • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker
Contents	1. Electrical conductor 1.1 Copper 1.2 Alumunium 1.3 Gold 1.4 Sliver 1.5 Brass 1.6 Water 2. Semiconductor 2.1 Charcoal 2.2 Carbon 2.3 Dilute sulfuric acid 2.4 Wet soil

	3. Insulator 3.1 Cotton. 3.2 Dry wood. 3.3 Stone. 3.4 Porcelain. 3.5 Glass 3.6 Rubber. 3.7 Ebonite. 3.8 Plastic. 4. Electrical measuring units 4.1 Volt (V). 4.2 Ampere (A). 4.3 Watt (W). 4.4 Kilowatt hour (Kwh). 4.5 Ohm 5. Sources of electricity 6. Nature of electricity 7. Difference between AC and DC 8. Measuring instruments 8.1 Wattmeter (Analog and Digital) 8.2 AVO meter/ Multimeter (Analog and Digital) 8.3 Clamp-on meter 9. Power and energy of a particular load
Job/ Task/ Activity	1. Identify electrical conductor, semi-conductor and insulator 2. Interpret measuring units 3. Identify measuring instruments 4. Measure voltage, current and resistance 5. Measure power and energy of particular load
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 electric circuits	
Assessment Criteria	1. Electrical circuit is explained. 2. Types electrical circuits are classified 3. Series, parallel and mixed circuit is interpreted. 4. Parameters of electrical circuits is calculated and measured;
Conditions and Resources	• Workplace or Simulated Workplace • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker
Contents	1. Electrical circuit 2. Types electrical circuits 3. Electrical properties of series, parallel and mixed circuits 4. Parameters of electric circuit 4.1 Voltage 4.2 Current 4.3 Resistance 4.4 Power 4.5 Energy 4.6 Frequency
Job/ Task/ Activity	1. Draw different types electrical circuit; 2. Calculate and measure parameter of electric circuit
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: Perform electrical wiring	
Assessment Criteria	1. PPE is used and OSH is maintained 2. Connection of series circuit by two lamps controlled from a switch is performed using channel wiring; 3. Connection of parallel circuit by two lamps controlled from individual switch is performed using channel wiring 4. Connection of series parallel circuit by three lamps from individual switches is performed using channel wiring 5. Connection of tube light is performed. 6. Connection of ceiling fan is performed.
Conditions and Resources	• Workplace or Simulated Workplace • Lamp • Switches • Channel • Tube light • Ceiling fan • PPE • CBLM • Handout • Multimedia Projector • Paper, Pen, Pencil and Eraser • White Board and marker
Contents	1. Procedure of connecting series, parallel and mixed cicuit 2. Electrical properties of series, parallel and mixed circuits 3. Connection of tube light 4. Connection of ceiling fan
Job/ Task/ Activity	1. Prepare series, parallel and mixed cicuits 2. Carry out connection of tube light 3. Carry out connection of ceiling fan
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 and stored. 2. Workplace is cleaned and kept tidy as per work place requirement. 3. Wastages are disposed as per workplace and environmental standard.
Conditions and Resources	• Workplace or Simulated Workplace • Tools and equipment • CBLM • Handout • Multimedia Projector • White Board and marker
Contents	1. Cleaning and storing procedure of tools and equipment. 2. Wastage disposal procedure;
Job/ Task/ Activity	1. 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

Unit of Competency	**Estimate Load for Installation of Off-Grid System**
Unit Code	**OU-LE-SESIM-03-L1-V1**
Module Title	Estimating Load for Installation of Off-Grid System
Module Descriptor	This unit of competency requires the knowledge, skills and attitude to estimate load for installation of off-grid system. It includes the tasks of calculating electrical load, identifying specific requirements, selecting off-grid system size and performing measurement
Nominal Hours	**20 Hours**
Learning Outcome	After completing the practice of the module, the trainees will be able to perform the following jobs: 1. Calculate electrical load 2. Identify specific requirements 3. Select off-grid system size 4. Perform measurement

Learning Outcome -1: Calculate electrical load	
Assessment Criteria	1. Customer requirements are identified 2. Types of loads are identified 3. Total load is estimated as per requirement.
Conditions and Resources	• Workplace or Simulated Workplace • PPE • CBLM • Handout • Multimedia Projector • Paper, Pen, Pencil and Eraser • White Board and marker
Contents	1. Customer requirement 1.1 DC load 1.2 AC load 1.3 Working hour/ backup time 1.4 Special requirement for equipment 1.4.1 Panel size 1.4.2 Panel type 1.4.3 Battery size 1.4.4 Battery type 1.4.5 Inverter size and type
Job/ Task/ Activity	1. Identify requirement of customer 2. Identify types of loads 3. Estimate total loads
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 specific requirements	
Assessment Criteria	1. Location of all components and accessories are identified as per standard; 2. Space for PV module is measured; 3. Length of cables is measured;
Conditions and Resources	• Workplace or Simulated Workplace • Layout drawing • Calculator • Major components list • Accessories list • Standard wire gauge • CBLM • Handout • Paper, Pen, Pencil and Eraser • White Board and marker
Contents	1. Procedure of identify components and accessories 2. Procedure of selection location of PV module 3. Procedure of calculation of cable length
Job/ Task/ Activity	1. Identify the location of components and accessories for a installation 2. Select and measure the location of a PV module 3. Calculate the measurement of cable required for a 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: Select off-grid system size	
Assessment Criteria	1. Total requirement of components and accessories are estimated. 2. Major components are selected
Conditions and Resources	• Workplace or Simulated Workplace • Manufacturer manual • Lists of components and accessories • CBLM • Handout • Paper, Pen, Pencil and Eraser • White Board and marker
Contents	1. Major Component 1.1 PV Module 1.2 Battery 1.3 Charge controller 1.4 Load 1.5 Inverter and Converter 2. Preparing components and accessories lists
Job/ Task/ Activity	1. Select components and accessories for a specific installation 2. Prepare total components and accessories lists for a specific 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 -4: Perform measurement	
Assessment Criteria	1. OSH is followed and PPE is used; 2. Instruments are selected to measure electrical quantities. 3. Basic tests are performed as per standard
Conditions and Resources	• Workplace or Simulated Workplace • Tools • PPE • Basic test instrument • CBLM • Handout • White Board and marker
Contents	1. OSH procedure 2. PPE 2.1 Apron 2.2 Hand gloves 2.3 Face mask 2.4 Safety shoes 2.5 Goggles 2.6 Safety helmet. 3. Instrunents 3.1 Multimeter 3.2 Wattmeter (analogue and digital) 3.3 Megger, 500v / 1000v (analogue and digital) 3.4 Earth tester 4. Basic test 4.1 Insulation resistance test 4.2 Polarity test 4.3 Continuity test 4.4 AC/ DC parameters 4.5 Earth resistance test
Job/ Task/ Activity	1. Select instruments for measuring electrical quantities 2. Perform basic test 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	**Interpret Drawing and Specifications for Off-Grid System**
Unit Code	**OU-LE-SESIM-04-L1-V1**
Module Title	Interpreting Drawing and Specifications for Off-Grid System
Module Descriptor	This unit covers the knowledge, skills and attitudes required to interpret drawing and specifications for off-grid system. It specifically includes – Identify signs, symbols and specifications in the layout drawings, interpret layout drawings and apply freehand sketching.
Nominal Hours	**50 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. Tools and equipment are identified, 3. Components, assemblies and materials are listed. 4. Dimensions of SES equipment with electrical accessories are identified. 5. 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. Interpret layout drawing 2. Draw a freehand sketch wiring diagram
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 Off-Grid System**
Unit Code	**OU-LE-SESIM-05-L1-V1**
Module Title	Using Hand tools and Power Tools in Off-Grid System
Module Descriptor	This unit covers the knowledge, skills and attitudes required to use hand tools and power tools in off-grid system It specifically includes - select hand and power tools, practice to use hand and power tools and maintain hand 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 and power tools	
Assessment Criteria	1. Appropriate hand and power tools are selected as per requirement of the task. 2. Usages of hand and power tools are interpreted. 3. Unsafe or defective hand 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. 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. 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 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. Interpretation of use of hand tools as per job requirements 2. Interpretation of use of power tools as per job requirements 3. Maintaining of proper mind and body concentration during works
Job/ Task/ Activity	1. Use hand tools as per user manual 2. Use power tools as per user manual 3. Demonstating maintaining proper mind and body concentration during works

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 • Multimedia Projector • 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 Off-Grid SES and Solar Street Light**
Unit Code	**OU-LE-SESIM-06-L1-V1**
Module Title	Installing Off-Grid SES and Solar Street Light
Module Descriptor	This unit of competency requires the knowledge, skills and attitude required to install off-grid SES and solar street light. It specifically includes the tasks of identifying SES components, locating and preparing places, handling components, setting the PV modules and installing 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 SES components 2. Locate and prepare places 3. Handle components 4. Set the PV modules 5. Install components

Learning Outcome -1: Identify SES components	
Assessment Criteria	1. Personal protective equipment is used and OSH is followed; 2. Special rope, safety belts and ladder are used while working on workplace 3. SES components are identified and selected 4. Functionality of the components are ensured.
Conditions and Resources	• Workplace or Simulated Workplace • PPE • Hand and power tools • Solar panel fixing accessories • Solar panel • CBLM • Handout • Paper, Pen, Pencil and Eraser • White Board and marker
Contents	1 OSH guide line 2 Use of PPE 3 SES components 4.1 PV Module 4.2 Charge controller 4.3 Battery 4.4 Inverter 4.5 Cables (AC and DC) 4.6 Loads (If necessary) 4.7 Solar street light
Job/ Task/ Activity	1. Select PPE 2. Select and identify SES components 3. Test the fuction of SES 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 of SES	
Assessment Criteria	1. Appropriate place with maximum sunlight exposure for panel setting located. 2. Obstacle against the sunlight is removed.
Conditions and Resources	• Workplace or Simulated Workplace • Solar panel • Panel mounting Structure • 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 near the house
Job/ Task/ Activity	1. Interpret appropriate place for installation of PV module 2. Select and prepare place for PV 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 standard
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 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

Learning Outcome -4: Install the PV modules	
Assessment Criteria	1. Erection of Mounting Structure with tilt angle within 15 to 25 degree is demonstrated. 2. Setting the panel within the mounting structure is demonstrated.
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. 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 PV module. 1.3 Mounting pole for solar street light
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 components	
Assessment Criteria	1. Charge controller is installed as per layout plan; 2. Battery is placed as per layout plan; 3. Inverter is placed on board as per layout plan; 4. Light fixtures are installed as per layout plan; 5. Electrical fittings and fixtures are installed as per layout plan.
Conditions and Resources	• Workplace or Simulated Workplace • Tools and equipment • SES components and structures • CBLM • Handout • White Board and marker
Contents	1. List of SES components and structures 2. Layout plan 3. Installation procedure of SES components 4. Fitting procedure of fittings and fictures
Job/ Task/ Activity	1. Install charge controller as layout plan 2. Set battery as per layout plan 3. Install inverter as per layout plan 4. Fix fittings and fictures 5. Set other accessories as per layout plan
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	**Perform Wiring for Off-Grid SES and Solar Street Light**
Unit Code	**OU-LE-SESIM-07-L1-V1**
Module Title	Performing Wiring for Off-Grid SES and Solar Street Light
Module Descriptor	This unit of competency requires the knowledge, skills and attitude required to perform wiring for off-grid SES and solar street light. It specially includes the tasks of identifying the route of conduits wiring, estimating the materials, laying the conduit and installing 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. Identify the route of conduits wiring. 2. Estimate the materials 3. Lay the conduit 4. Install wiring

Learning Outcome -1: Identify the route of conduits wiring.	
Assessment Criteria	1. Plan or drawing is collected. 2. Wiring diagram of the electrical installation is collected. 3. Location of distribution boards (DB), sub distribution boards (SDB), light fixtures, ceiling fans, switches, sockets are identified as per selected drawing.
Conditions and Resources	• Workplace or Simulated Workplace • Drawing • Wiring diagram • Handout • Paper, Pen, Pencil and Eraser • White Board and marker
Contents	1 Plan or drawing 2 Wiring diagram of the electrical installation
Job/ Task/ Activity	1. Identify the location of electrical fitting and fixures on a diagram
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: Estimate the materials	
Assessment Criteria	1. Distance of all SDB, Light, Fan, Switch and Socket from Main Distribution Board (MDB) is summed up. 2. Total quantity of the conduits and cables is estimated 3. Total numbers of DB, SDB, Light, Fan, Switch and Socket with specification are estimated. 4. Total quantity of protective device and installation materials are estimated.
Conditions and Resources	• Workplace or Simulated Workplace • Drawing • Wiring diagram • Estimating of accessories • CBLM • Handout • Paper, Pen, Pencil and Eraser • White Board and marker
Contents	1. Drawing 2. Wiring diagram 3. Estimating procedure 4. Estimating total quantities 5. Protective devices 5.1 FUSE 5.2 MCB 5.3 MCCB 6. Installation materials 6.1 PVC conduits, Junction boxes, bends, elbows. 6.2 PVC cables (4 rm, 2.5 rm, 1.5 rm and 1.5 re). 6.3 GI wire 6.4 Distribution boards. 6.5 Sub distribution boards. 6.6 Light fixtures. 6.7 Ceiling fans. 6.8 Switches. 6.9 Combined switch sockets. 6.10 Insulation tapes. 6.11 Rawl plugs and screws.
Job/ Task/ Activity	1. Summed up the distance of all SDB, Light, Fan, Switch and Socket from Main Distribution Board (MDB). 2. Estimate the total quantity of the conduits and cables. 3. Estimate the total numbers of DB, SDB, Light, Fan, Switch and Socket with specification. 4. Estimate the total quantity of protective device and installation materials.

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: Lay the conduit	
Assessment Criteria	1. Hand tools, power tools and equipment are identified. 2. Conduits straight along the distance from DB to every SDB, Light, Fan, Socket are laid as applicable. 3. Conduits in the slots are laid.
Conditions and Resources	• Workplace or Simulated Workplace • Tools, equipments and materials • Wiring diagrams • CBLM • Handout • Multimedia Projector • Paper, Pen, Pencil and Eraser • White Board and marker
Contents	1. Hand tools 1.1 Screw drivers. 1.2 Diagonal cutting pliers. 1.3 Long nose pliers. 1.4 Combination pliers. 1.5 Electrician knife. 1.6 Neon tester. 1.7 Hack saw with blade. 2. Power tools 2.1 Electric hand drill machine with bits 2.2 Electric slot cutting machine with cutting disc. 3. Equipments 3.1 Multimeter 3.2 Clamp on meter 3.3 Spirit level. 3.4 Measuring tape 3.5 Protractor 4. Use of job-related hand and power tools 5. Procedure of perform conduit wiring
Job/ Task/ Activity	1. List the job-related hand and power tools 2. Carry out conduit wiring as per wiring diagram;
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 wiring	
Assessment Criteria	1. Proper personal protective equipment (PPE) is used during performance of the works 2. Cables are pulled in every conduit as per specification. 3. Load are connected to operate with individual controlling device. 4. Circuit is tested by testing equipment and power is supplied.
Conditions and Resources	• Workplace or Simulated Workplace • PPE • Tools and equipment • Wiring diagram • Wiring materials • Controlling devices • Circuit testing devices • CBLM • Handout • White Board and marker
Contents	1. Cable pulling procedure through conduit; 2. Load connecting procedure 3. Procedure of testing circuit by using testing equipment
Job/ Task/ Activity	1. Pull cable through conduit for specific job; 2. Connect load and controlling devices 3. Test the circuit 4. Connect the circuit to the power supply
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 Off Grid Solar System**
Unit Code	**OU-LE-SESIM-08-L1-V1**
Module Title	Troubleshooting and Maintaining Off Grid Solar System
Module Descriptor	This unit of competency covers the knowledge, skills and attitude required to troubleshoot and maintain of off grid solar system. It specially includes the tasks of performing routine maintenance, diagnosing faults in SES units and wiring and repaired the faults in SES unit and wiring.
Nominal Hours	**40 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 Use of PPE 3 Maintenance schedule
Job/ Task/ Activity	1. Interpret safe work environment and corrective action 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 structure • 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 -4: 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. Procedure of repair faults of SES unit
Job/ Task/ Activity	1 Repair and 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	1. 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-01 is validated by NSDA on 27 July 2025.

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