

# COMPETENCY-BASED CURRICULUM



Sector:

**CONSTRUCTION**

Qualification:

**PV SYSTEMS INSTALLATION NC II**



**TECHNICAL EDUCATION AND SKILLS DEVELOPMENT AUTHORITY**  
East Service Road, South Superhighway, Taguig City, Metro Manila

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## **COURSE DESIGN**

**COURSE TITLE : PV SYSTEMS INSTALLATION NC II**

**NOMINAL DURATION : 284 Hours**

**COURSE DESCRIPTION :**

The course is designed to enhance the knowledge, desirable attitudes and skills of a PV Systems installation technician in accordance with industry standards. It covers core competencies such as: perform site assessment, check PV components and materials' compliance, install and commission PV system and prepare documentation requirements for PV systems installation.

It also includes competencies in workplace communication; work in a team environment, practice career professionalism, practice occupational health and safety, prepare construction materials and tools, perform mensuration and calculation, maintain tools and equipment, observe procedures, specifications and manuals of instructions and interpret technical drawings and plans.

**ENTRY REQUIREMENTS:**

An individual who wishes to undergo this course must possess the following:

- With good moral character
- Can communicate both oral and written
- At least 18 yrs old

**COURSE STRUCTURE:****BASIC COMPETENCIES  
(18 hours)**

<b>Units of Competency</b>	<b>Module Title</b>	<b>Learning Outcomes</b>	<b>Nominal Duration</b>
1. Participate in workplace communication	1.1 Participating in workplace communication	1.1.1 Obtain and convey workplace information 1.1.2 Participate in workplace meeting and discussion 1.1.3 Complete relevant work-related document	4 hours
2. Work in a team environment	2.1 Working in a team environment	2.1.1 Describe and identify team role and responsibility 2.1.2 Describe work as a team member	4 hours
3. Practice career professionalism	3.1 Practicing career professionalism	3.1.1 Integrate personal objectives with organizational goals. 3.1.2 Set and meet work priorities. 3.1.3 Maintain professional growth and development.	4 hours
4. Practice occupational health and safety procedures	4.1 Practicing occupational health and safety procedure	4.1.1 Identify hazards and risks. 4.1.2 Evaluate hazards and risks. 4.1.3 Control hazards and risks. 4.1.4 Maintain occupational health and safety awareness.	6 hours

**COMMON COMPETENCIES  
(72 hours)**

<b>Units of Competency</b>	<b>Module Title</b>	<b>Learning Outcomes</b>	<b>Nominal Duration</b>
1. Prepare construction materials and tools	1.1 Preparing construction materials and tools.	1.1.1 Identify materials and tools applicable to a specific construction job 1.1.2 Request appropriate materials and tools 1.1.3 Receive and inspect materials.	12 hours
2. Perform mensuration and calculation	2.1 Performing mensuration and calculations	2.1.1 Carry out measurements and calculations. 2.1.2 Select measuring instruments.	24 hours
3. Maintain tools and equipment.	3.1 Maintaining tools and equipment.	3.1.1 Check condition of tools and equipments. 3.1.2 Perform basic preventive maintenance 3.1.3 Store tools and equipment	12 hours

<b>Units of Competency</b>	<b>Module Title</b>	<b>Learning Outcomes</b>	<b>Nominal Duration</b>
4. Observe procedures, specifications and manuals of instructions	4.1 Observing procedures, specifications, and manuals of instructions.	4.1.1 Identify, access, and interpret specification/ manuals. 4.1.2 Apply information in manual. 4.1.3 Store manuals.	8 hours
5. Interpret technical drawings and plans	5.1 Interpret technical drawings and plans	5.1.1 Analyze signs, symbols, and data. 5.1.2 Interpret technical drawings and plans	16 hours

### **CORE COMPETENCIES (194 hours)**

<b>Units of Competency</b>	<b>Module Title</b>	<b>Learning Outcomes</b>	<b>Nominal Duration</b>
1. Perform site assessment	1.1 Performing site assessment	1.1.1 Validate parameters for the installation 1.1.2 Prepare installation data sheet 1.1.3 Prepare site assessment report	30 hours
2. Check PV components/ materials compliance	2.1 Checking PV components/ materials compliance	2.1.1 Inspect and test components and materials 2.1.2 Interpret individual component manuals 2.1.3 Report test results	44 hours
3. Install PV system	3.1 Preparing documentation on PV system	3.1.1 Plan and prepare work 3.1.2 Complete relevant work related documents	4 hours
	3.2 Installing PV components	3.2.1 Install PV Module/Panel/Array 3.2.2 Install Controller 3.2.3 Install Battery 3.2.4 Install Inverter	34 hours
	3.3 Installing electrical wiring	3.3.1 Prepare electrical tools, materials and equipment 3.3.2 Read and interpret electrical diagrams 3.3.3 Install lighting and power circuit using electrical non-metallic conduit. 3.3.4 Install light and power circuit using sheathed non-metallic cable 3.3.5 Install light and power circuit using electrical non-metallic surface raceway.	58 hours

<b>Units of Competency</b>	<b>Module Title</b>	<b>Learning Outcomes</b>	<b>Nominal Duration</b>
4. Perform PV system commissioning	4.1 Performing PV system commissioning	4.1.1 Prepare to commission PV system 4.1.2 Commission PV system 4.1.3 Inspect and notify completion of work	24 hours

#### ASSESSMENT METHODS:

- Written test
- Practical/performance test
- Interview/oral Questioning
- Demonstration

#### COURSE DELIVERY:

- Film Viewing
- Lecture/discussion
- Multimedia presentation
- Self-pace learning
- Field trip

#### RESOURCES:

<b>LEARNING ELEMENTS/HANDOUTS</b>	
<ul style="list-style-type: none"> <li>• Electrical Safety</li> <li>• Diagrams</li> <li>• Measuring resistance using VOM</li> <li>• Measuring voltage using VOM</li> <li>• Installing rigid non-metallic conduit</li> <li>• Installing electrical moldings</li> <li>• Identifying and selecting electrical materials and tools</li> </ul>	<ul style="list-style-type: none"> <li>• Installing electrical wiring</li> <li>• Installing wiring devices</li> <li>• Installing circuit protection system</li> <li>• Splicing and joining electrical conductor</li> <li>• Performing mensurations and calculations</li> <li>• PV systems components</li> <li>• Battery maintenance</li> <li>• Types of Loads</li> </ul>
<b>VIDEO PROGRAMS</b> <ul style="list-style-type: none"> <li>• Safety Practices in Workshop</li> <li>• Electrical Safety</li> <li>• Electrical installation</li> </ul>	
<b>TRANSPARENCY</b> <ul style="list-style-type: none"> <li>• Electrical Safety</li> <li>• Diagrams</li> <li>• Meter scale reading</li> <li>• Measuring Voltage using VOM</li> <li>• Parts of multi-tester</li> <li>• PV Systems and Components</li> </ul>	

## BOOKS

- Alerich, Walter. **Electrical Construction Wiring**, Illinois: American Technical Publisher; 1971, pp.*
- Anderson, Edwin, Andels. **Wiring Diagram for Light and Power**, Bombay: D.B. Taraporevala sons and Co.; 1969.*
- Croft T and Summers W. **American Electricians Handbook**, New York: McGraw-Hill Book Co. Inc; 1927, pp.*
- Handley, William, **Industrial Safety Handbook**, McGraw Hill Book Co.; 1977, pp.*
- Hubert, Charles I. **Preventive maintenance of Electrical Equipment-2<sup>nd</sup> Ed.**, New York: McGraw Hill Book Co; 1974, pp.*
- Institute of Integrated Electrical Engineers, Inc. **Philippine Electrical Code, Part I, 2002**, # 41, Monte de Piedad St. Cubao, Quezon City, Philippines: Bookman Inc; June 2002.*
- Institute of Integrated Electrical Engineers, Inc. **Philippine Electrical Code, Part II, 2002**, # 41, Monte de Piedad St. Cubao, Quezon City, Philippines: Bookman Inc; June 2002.*
- Jacobowitz, Henry. **Electricity Made Simple**, New York: Doubleday and Company; 1967, pp*
- Lister, Eugene. **Electric Circuits and Machines**, The Institute of Electrical and Electronics Engineers Inc; McGraw Hill Book Co; 1975*
- Lunt, Joseph R. **Everyday Electricity**, New York: The Macmillan Co; 1934, pp.*
- Mulin R.C., Smith R.L. **Electrical Wiring-Commercial, Six Ed.**, New York: Delmar's Publishing Inc; 1984, pp.*
- Vankelburg, Van; Nooger and Neville Inc. **Electricity**, New Jersey: Hayden Book Co. Inc; 1978, pp*

## LOCATION

- Demonstration house
- Wiring booth

## EQUIPMENTS

- |   |   |
|---|---|
| <ul style="list-style-type: none"><li>• PV module/panel/array</li><li>• Support structure</li><li>• Controller</li><li>• Battery</li><li>• Battery Box</li><li>• Inverter</li><li>• Converter</li></ul> | <ul style="list-style-type: none"><li>• Loads (Ac/Dc)</li><li>• PPE<ul style="list-style-type: none"><li>○ Safety goggles</li><li>○ Rubber gloves</li><li>○ Safety shoes</li><li>○ Face Mask</li><li>○ Leather apron</li><li>○ Safety Harness</li></ul></li></ul> |
|---|---|

<b>TOOLS</b> <ul style="list-style-type: none"> <li>• Electrician's holster</li> <li>• Linesman's pliers</li> <li>• Long nose pliers</li> <li>• Diagonal cutting pliers</li> <li>• Hacksaw</li> <li>• Claw hammer</li> <li>• Spirit level</li> <li>• Set of screw drivers</li> <li>• DC drill</li> <li>• Soldering Iron</li> <li>• Measuring tape</li> <li>• Wrench</li> <li>• Wire Stripper</li> <li>• Magnetic Compass</li> <li>• Scaffolding/Ladder</li> </ul>	<b>MEASURING TOOLS</b> <ul style="list-style-type: none"> <li>• Multi-tester</li> <li>• Clamp meter</li> <li>• Hydrometer</li> <li>• Battery cell tester</li> </ul>
<b>MATERIALS</b>	
<ul style="list-style-type: none"> <li>• Boxes and fittings <ul style="list-style-type: none"> <li>○ Junction box</li> <li>○ Utility box</li> <li>○ Pull box</li> <li>○ Condulets</li> <li>○ PVC adapters</li> <li>○ Lock nut and bushing</li> <li>○ C-clamps</li> </ul> </li> <li>• Electrical conductors <ul style="list-style-type: none"> <li>○ Solid wire 2.0 mm<sup>2</sup></li> <li>○ Solid wire 3.5 mm<sup>2</sup></li> <li>○ Solid wire 2.6 mm<sup>2</sup></li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• PVC pipe</li> <li>• PVC molding</li> <li>• Wood molding</li> <li>• Fastening devices</li> <li>• Mica tube</li> <li>• Circuit breakers and fuses</li> <li>• Connectors</li> <li>• Clamps</li> <li>• Diodes</li> <li>• Electrical tape</li> <li>• Soldering lead</li> <li>• Bolts and nuts</li> </ul>

#### QUALIFICATION OF INSTRUCTORS/TRAINERS

- Must be a holder of at least PV Installation NC II
- Must have undergone training on Training Methodology II (TM II)
- Must be computer literate
- Must be physically and mentally fit
- Must have at least 2 years job/ industry experience (optional)



# **MODULES OF INSTRUCTION**

## **BASIC COMPETENCIES**

### **PV SYSTEMS INSTALLATION NC II**

**BASIC COMPETENCY : COMMUNICATIONS**

**UNIT OF COMPETENCY : PARTICIPATE IN WORKPLACE COMMUNICATION**

**MODULE TITLE : PARTICIPATING IN WORKPLACE COMMUNICATION**

**MODULE DESCRIPTOR :** This module covers the knowledge, skills and attitudes required to obtain, interpret and convey information in response to workplace requirements.

**NOMINAL DURATION : 4 hours**

**QUALIFICATION LEVEL : NC II**

**SUMMARY OF LEARNING OUTCOMES:**

Upon completion of this module the students/ trainees will be able to:

LO1. Obtain and convey workplace information

LO2. Complete relevant work related documents.

LO3. Participate in workplace meeting and discussion.

## **LO1. OBTAIN AND CONVEY WORKPLACE INFORMATION**

### **ASSESSMENT CRITERIA:**

1. Specific relevant information is accessed from appropriate sources.
2. Effective questioning, active listening and speaking skills are used to gather and convey information.
3. Appropriate medium is used to transfer information and ideas.
4. Appropriate non-verbal communication is used.
5. Appropriate lines of communication with superiors and colleagues are identified and followed.
6. Defined workplace procedures for the location and storage of information are used.
7. Personal interaction is carried out clearly and concisely.

### **CONTENTS:**

- Parts of speech
- Sentence construction
- Effective communication

### **CONDITIONS:**

The students/ trainees must be provided with the following:

- Writing materials (pen & paper)
- References (books)
- Manuals

### **METHODOLOGIES:**

- Group discussion
- Interaction
- Lecture
- Reportorial

### **ASSESSMENT METHODS:**

- Written test
- Practical/performance test
- Interview

## **LO2. COMPLETE RELEVANT WORK RELATED DOCUMENTS**

### **ASSESSMENT CRITERIA:**

1. Ranges of forms relating to conditions of employment are completed accurately and legibly.
2. Workplace data is recorded on standard workplace forms and documents.
3. Basic mathematical processes are used for routine calculations.
4. Errors in recording information on forms/ documents are identified and rectified.
5. Reporting requirements to superior are completed according to enterprise guidelines.

### **CONTENTS:**

- Basic mathematics
- Technical writing
- Types of forms

### **CONDITIONS:**

The students/trainees must be provided with the following:

- Paper
- Pencils/ball pen
- Reference books
- Manuals

### **METHODOLOGIES:**

- Group discussion
- Interaction
- Lecture

### **ASSESSMENT METHODS:**

- Written test
- Practical/performance test
- Interview

### **LO3. PARTICIPATE IN WORKPLACE MEETINGS AND DISCUSSIONS**

#### **ASSESSMENT CRITERIA:**

1. Team meetings are attended on time.
2. Own opinions are clearly expressed and those of others are listened to without interruption.
3. Meeting inputs are consistent with the meeting purpose and established protocols.
4. Workplace interaction are conducted in a courteous manner appropriate to cultural background and authority in the enterprise procedures.
5. Questions about simple routine workplace procedures and matters concerning conditions of employment are asked and responded.
6. Meeting outcomes are interpreted and implemented.

#### **CONTENTS:**

- Sentence construction
- Technical writing
- Recording information

#### **CONDITIONS:**

The students/trainees must be provided with the following:

- Paper
- Pencils/ball pen
- References (books)
- Manuals

#### **METHODOLOGIES:**

- Group discussions
- Interaction
- Lecture

#### **ASSESSMENT METHODS:**

- Written test
- Practical/performance test
- Interview

**BASIC COMPETENCY : TEAM WORK**

**UNIT OF COMPETENCY : WORK IN A TEAM ENVIRONMENT**

**MODULE TITLE : WORKING IN A TEAM ENVIRONMENT**

**MODULE DESCRIPTOR :** This module covers the knowledge, skills, and attitudes required to relate in a work based environment.

**NOMINAL DURATION : 4 hours**

**QUALIFICATION LEVEL : NC II**

**SUMMARY OF LEARNING OUTCOMES:**

Upon completion of this module, the students/ trainees will be able to:

LO1. Describe and identify team role and responsibility in a team.

LO2. Describe work as a team.

## **LO1. DESCRIBE AND IDENTIFY TEAM ROLE AND RESPONSIBILITY IN A TEAM**

### **ASSESSMENT CRITERIA:**

1. Role and objective of the team is identified.
2. Team parameters, relationships and responsibilities are identified.
3. Individual role and responsibilities within team environment are identified.
4. Roles and responsibilities of other team members are identified and recognized.
5. Reporting relationships within team and external to team are identified.

### **CONTENTS:**

- Team role.
- Relationship and responsibilities
- Role and responsibilities with team environment.
- Relationship within a team.

### **CONDITIONS:**

The students/ trainees must be provided with the following:

- Standard operating procedure (SOP) of workplace
- Job procedures
- Client/supplier instructions
- Quality standards
- Organizational or external personnel

### **METHODOLOGIES:**

- Group discussion/interaction
- Case studies
- Simulation

### **ASSESSMENT METHODS:**

- Written test
- Observation
- Simulation
- Role playing

## **LO2. DESCRIBE WORK AS A TEAM MEMBER**

### **ASSESSMENT CRITERIA:**

1. Appropriate forms of communication and interactions are undertaken.
2. Appropriate contributions to complement team activities and objectives were made.
3. Reporting using standard operating procedures followed.
4. Development of team work plans based from role team were contributed.

### **CONTENTS:**

- Communication process
- Team structure/team roles
- Group planning and decision making

### **CONDITIONS:**

The students/trainees must be provided with the following:

- SOP of workplace
- Job procedures
- Organization or external personnel

### **METHODOLOGIES:**

- Group discussion/interaction
- Case studies
- Simulation

### **ASSESSMENT METHODS:**

- Observation of work activities
- Observation through simulation or role play
- Case studies and scenarios.



UNIT OF COMPETENCY : **PRACTICE CAREER PROFESSIONALISM**

MODULE TITLE : **PRACTICING CAREER PROFESSIONALISM**

MODULE DESCRIPTOR : This module covers the knowledge, skills and attitudes in promoting career growth and advancement, specifically, to integrate personal objectives with organizational goals set and meet work priorities and maintain professional growth and development.

NOMINAL DURATION : 6 hours

QUALIFICATION LEVEL : NC II

**SUMMARY OF LEARNING OUTCOMES:**

Upon completion of this module, the trainee/student must be able to:

LO1. Integrate personal objectives with organizational goals

LO2. Set and meet work priorities

LO3. Maintain professional growth and development

## **LO1. INTEGRATE PERSONAL OBJECTIVES WITH ORGANIZATIONAL GOALS**

### **ASSESSMENT CRITERIA:**

1. Personal growth and work plans towards improving the qualifications set for professionalism are evident.
2. Intra and interpersonal relationship in the course of managing oneself based on performance evaluation is maintained.
3. Commitment to the organization and its goal is demonstrated in the performance of duties.
4. Practice of appropriate personal hygiene is observed.
5. Job targets within key result areas are attained.

### **CONTENTS:**

- Personal development-social aspects: intra and interpersonal development
- Organizational goals
- Personal hygiene and practices
- Code of ethics

### **CONDITIONS:**

The students/ trainees must be provided with the following:

- Workplace
- Code of ethics
- Organizational goals
- Hand outs and Personal development-social aspects
- CD's, VHS tapes, transparencies

### **METHODOLOGIES:**

- Interactive -lecture
- Simulation
- Demonstration
- Self paced instruction

### **ASSESSMENT METHODS:**

- Role play
- Interview
- Written examination

## **LO2. SET AND MEET WORK PRIORITIES**

### **ASSESSMENT CRITERIA:**

1. Competing demands to achieve personal, team and organizational goals and objectives are prioritized.
2. Resources are utilized efficiently and effectively to manage work priorities and commitments.
3. Practices and economic use and maintenance of equipment and facilities are followed as per established procedures.
4. Job targets within key result areas are attained.

### **CONTENTS:**

- Organizational Key Result Areas (KRA)
- Work values and ethical standards
- Company policies on the use and maintenance of equipment

### **CONDITIONS:**

The students/ trainees must be provided with the following

- Hand outs on
  - Organizational KRA
  - Work values and ethics
  - Company policies and standards
  - Sample job targets
- Learning guides
- CD's, VHS tapes, transparencies

### **METHODOLOGIES:**

- Interactive lecture
- Group discussion
- Structured activity
- Demonstration

### **ASSESSMENT METHODS:**

- Role play
- Interview
- Written examination

### **LO3. MAINTAIN PROFESSIONAL GROWTH AND DEVELOPMENT**

#### **ASSESSMENT CRITERIA:**

1. Training and career opportunities relevant to the job requirements are identified and availed.
2. Licenses and/or certifications according to the requirements of the qualifications are acquired and maintained
3. Fundamental rights at work including gender sensitivity are manifested/ observed
4. Training and career opportunities based on the requirements of industry are completed and updated.

#### **CONTENTS:**

- Qualification standards
- Gender and development (GAD) sensitivity
- Professionalism in the workplace
- List of professional licenses

#### **CONDITIONS:**

The students/trainees must be provided with the following

- Quality standards
- GAD handouts
- CD's, VHS tapes on professionalism in the workplace
- Professional licenses samples

#### **METHODOLOGIES:**

- Interactive lecture
- Film viewing
- Role play/simulation
- Group discussion

#### **ASSESSMENT METHODS:**

- Demonstration
- Interview
- Written examination
- Portfolio assessment

UNIT OF COMPETENCY : **PRACTICE OCCUPATIONAL HEALTH AND SAFETY PROCEDURES**

MODULE TITLE : **PRACTICING OCCUPATIONAL HEALTH AND SAFETY PROCEDURES**

MODULE DESCRIPTOR : This module covers the knowledge, skills and attitudes required to comply with the regulatory and organizational requirements for occupational health and safety such as identifying, evaluating and maintaining occupational health and safety (OHS) awareness.

NOMINAL DURATION : 4 hours

QUALIFICATION LEVEL : NC II

**SUMMARY OF LEARNING OUTCOMES:**

Upon completion of this module, the trainee/student must be able to:

- LO1. Identity hazards and risks
- LO2. Evaluate hazards and risks
- LO3. Control hazards and risks
- LO4. Maintain occupational health and safety awareness

## **LO1. IDENTIFY HAZARDS AND RISKS**

### **ASSESSMENT CRITERIA:**

1. Workplace hazards and risks are identified and clearly explained.
2. Hazards/risks and its corresponding indicators are identified in with the company procedures.
3. Contingency measures are recognized and established in accordance with organizational procedures.

### **CONTENTS:**

- Hazards and risks identification and control
- Organizational safety and health protocol
- Threshold limit value (TLV)
- OHS indicators

### **CONDITIONS:**

The students/ trainees must be provided with the following:

- Workplace
- Personal protective equipment (PPE)
- Learning guides
- Hand-outs
  - Organizational safety and health protocol
  - OHS indicators
  - Threshold limit value
  - Hazards/risk identification and control
- CD's, VHS tapes, transparencies

### **METHODOLOGIES:**

- Interactive -lecture
- Simulation
- Symposium
- Group dynamics

### **ASSESSMENT METHODS:**

- Situation analysis
- Interview
- Practical examination
- Written examination

## **LO2. EVALUATE HAZARDS AND RISKS**

### **ASSESSMENT CRITERIA:**

1. Terms of maximum tolerable limits are identified based on threshold limit values (TLV)
2. Effects of hazards are determined.
3. OHS issues and concerns are identified in accordance with workplace requirements and relevant workplace OHS legislation.

### **CONTENTS:**

- TLV table
- Philippine OHS standards
- Effects of hazards in the workplace
- Ergonomics
- ECC Regulations

### **CONDITIONS:**

The students/trainees must be provided with the following

- Hand outs on
  - Philippine OHS standards
  - Effects of hazards in the workplace
  - Ergonomics
  - ECC regulations
- TLV table
- CD's, VHS tapes, transparencies

### **METHODOLOGIES:**

- Interactive lecture
- Situation analysis
- Symposium
- Film viewing
- Group dynamics

### **ASSESSMENT METHODS:**

- Interview
- Written examination
- Simulation

### **LO3. CONTROL HAZARDS AND RISKS**

#### **ASSESSMENT CRITERIA:**

1. OHS procedures for controlling hazards and risk are strictly followed.
2. Procedures in dealing with workplace accidents, fire and emergencies are followed in accordance with the organization's OHS policies.
3. Personal protective equipment (PPE) is correctly used in accordance with organization's OHS procedures and practices.
4. Procedures in providing appropriate assistance in the event of workplace emergencies are identified in line with the established organizational protocol.

#### **CONTENTS:**

- Safety regulations
  - Clean air act
  - Electrical and fire safety code
  - Waste management
  - Disaster preparedness and management
- Contingency measures and procedures

#### **CONDITIONS:**

The students/trainees must be provided with the following:

- Hand outs on
  - Safety Regulations
  - Clean air act
  - Electrical and fire safety code
  - Waste management
  - Disaster preparedness and management
  - Contingency measures and procedures
- OHS personal records
- PPE
- CD's, VHS tapes, transparencies

#### **METHODOLOGIES:**

- Interactive lecture
- Symposium
- Film viewing
- Group dynamics
- Self-paced instruction

#### **ASSESSMENT METHODS:**

- Written examination
- Interview
- Case/situation analysis
- Simulation



## **LO4. MAINTAIN OCCUPATIONAL HEALTH AND SAFETY AWARENESS**

### **ASSESSMENT CRITERIA:**

1. Procedures in emergency related drill are strictly followed in line with the established organization guidelines and procedures.
2. OHS personal records are filled up in accordance with workplace requirements.
3. PPE are maintained in line with organization guidelines and procedures.

### **CONTENTS:**

- Operational health and safety procedure, practices and regulations
- Emergency-related drills and training

### **CONDITIONS:**

The students/trainees must be provided with the following

- Workplace
- PPE
- OHS personal records
- CD's, VHS tapes, transparencies
- Health record

### **METHODOLOGIES:**

- Interactive lecture
- Simulation
- Symposium
- Film viewing
- Group dynamics

### **ASSESSMENT METHODS:**

- Demonstration
- Interview
- Written examination
- Portfolio assessment

# **MODULES OF INSTRUCTION**

## **COMMON COMPETENCIES**

### **PV SYSTEMS INSTALLATION NC III**

UNIT OF COMPETENCY : **PREPARE CONSTRUCTION MATERIALS AND TOOLS**  
:  
MODULE TITLE : **PREPARING CONSTRUCTION MATERIALS AND TOOLS**  
MODULE DESCRIPTION : This module covers the knowledge, skills and attitudes on identifying, requesting and receiving construction materials and tools based on the required performance standards.  
NOMINAL DURATION : 12 hours

SUMMARY OF LEARNING OUTCOMES :

Upon completion of the module the trainees/student should be able to:

- LO1. Identify materials and tools applicable to a specific construction job.
- LO2. Request appropriate materials and tools.
- LO3. Receive and inspect materials.

## **LO1. IDENTIFY MATERIALS AND TOOLS APPLICABLE TO A SPECIFIC CONSTRUCTION JOB**

### **ASSESSMENT CRITERIA:**

1. Tools and materials are identified as per job requirements
2. Tools are classified according to its function as per job requirements.
3. Materials are classified according to its uses to a specific construction project.
4. Tools and materials are selected as per job requirement.

### **CONTENT:**

- Types and uses of construction materials and tools
- Description of materials and tools
- Listing of materials as per company standards.

### **CONDITIONS:**

Students/trainees must be provided with the following:

- Workplace location
- Materials relevant to the unit of competency
- Materials and tools
  - Electrical
  - Structural
  - Welding
  - Masonry
  - Carpentry
  - Plumbing
  - Pipefitting
- Materials and tools different brand names, size, capacity and kind of application.
- Handouts/Instructional Materials

### **METHODOLOGIES:**

- Lecture - demonstration
- Self-paced instruction
- Group discussion
- PowerPoint presentation

### **ASSESSMENT METHODS:**

- Oral questioning
- Direct observation
- Written test

## **LO2. REQUEST APPROPRIATE MATERIALS AND TOOLS**

### **ASSESSMENT CRITERIA:**

1. Needed materials and tools listed as per job requirement.
2. Materials and tools are requested according to the list prepared.
3. Requests are done as per company standard operating procedures (SOP)
4. Materials and tools are substituted and provided unavailable without sacrificing cost and quality of work.

### **CONTENT:**

- Different forms
  - Job order slip
  - Tools and materials requisition slip
  - Borrower's Slip
- Requisition procedures

### **CONDITIONS:**

Students/trainees must be provided with the following:

- Sample of company standard in tools and materials requisition.
- Job order form
- Requisition slip
- Borrowers slip
- Handouts/Instructional Materials

### **METHODOLOGIES:**

- Lecture - demonstration
- Self-paced instruction
- Group discussion

### **ASSESSMENT METHODS:**

- Oral questioning
- Direct observation
- Written test

### **LO3. RECEIVE AND INSPECT MATERIALS**

#### **ASSESSMENT CRITERIA**

1. Received and inspected materials and tools as per quantity and specification based on requisition.
2. Tools and materials are checked for damages and manufacturing defects.
3. Materials and tools received are handled with appropriate safety devices.
4. Materials and tools are set aside to appropriate location nearest to the workplace.

#### **CONTENT:**

- Procedures in receiving tools and materials
- Proper inspection of tools and materials received.
- Proper handling of tools and materials.

#### **CONDITIONS:**

Students/trainees must be provided with the following:

- Sample of company standard in tools and materials in receiving materials.
- Inspection Checklist
- Materials Handling Safety Devices
- Inventory Form Handouts/Instructional Materials

#### **METHODOLOGIES:**

- Lecture - demonstration
- Self-paced instruction
- Group discussion

#### **ASSESSMENT METHODS:**

- Oral questioning
- Direct observation
- Written test

UNIT OF COMPETENCY : **PERFORM MENSURATIONS AND CALCULATIONS**

MODULE TITLE : **PERFORMING MENSURATIONS AND CALCULATIONS**

MODULE DESCRIPTION : This module covers the knowledge, skills and attitudes on identifying, and measuring objects based on the required performance standards.

NOMINAL DURATION : 24 hours

**SUMMARY OF LEARNING OUTCOMES:**

Upon completion of the module the trainees/student should be able to:

LO1. Carry out measurements and calculations.

LO2. Select measuring instruments.

## **LO1. CARRY OUT MEASUREMENTS AND CALCULATIONS**

### **ASSESSMENT CRITERIA:**

1. Calculation needed to complete work tasks are performed using the four basic process of addition (+), subtraction (-), multiplication (x) and division (/) including but not limited to: trigonometric functions, algebraic computations.
2. Calculations involving fractions, percentages and mixed numbers are used to complete workplace tasks
3. Numerical computations are self-checked and corrected for accuracy.
4. Accurate measurements are obtained according to job requirements.
5. Identified and converted systems of measurement according to job requirements.
6. Measured work pieces according to job requirements.

### **CONTENT:**

#### **Trade Mathematics/Mensuration**

- Four fundamental operation
- Kinds of measurement
- Dimensions
- Ratio and Proportion
- Trigonometric Functions
- Algebraic Equations
- Fractions, Percentage and Decimals
- Conversion

### **CONDITIONS:**

Students/trainees must be provided with the following:

- Classroom for discussion
- Workplace Location
- Problems to solve
- Measuring instruments
- Instructional materials relevant to the propose activity.

### **METHODOLOGIES:**

- Lecture - demonstration
- Self-paced instruction
- Group discussion

### **ASSESSMENT METHODS:**

- Oral questioning
- Direct observation
- Written test



## **LO2. SELECT MEASURING INSTRUMENTS**

### **ASSESSMENT CRITERIA:**

1. Object or component to be measured are identified, classified and interpreted according to the appropriate regular geometric shape.
2. Measuring tools are selected/identified as per object to be measured or job requirements
3. Correct specifications are obtained from relevant sources.
4. Measuring instruments are selected according to job requirements.
5. Alternative measuring tools are used without sacrificing cost and quality of work.
6. Measurements are obtained according to job requirements.

### **CONTENTS**

- Visualizing objects and shapes specifically geometric shapes.
- Interpreting Formulas for volume, areas, and perimeters of plane and geometric figures.
- Measuring Instruments/Measuring Tools
- Proper handling of measuring instruments

### **CONDITIONS:**

Students/trainees must be provided with the following:

- Classroom for discussion
- Workplace Location
- Problems to solve
- Measuring instruments
- Instructional materials relevant to the propose activity.

### **METHODOLOGIES:**

- Actual demonstration
- Classroom discussions

### **ASSESSMENT METHODS:**

- Actual demonstration
- Direct observation
- Written test/questioning

UNIT OF COMPETENCY : **MAINTAIN TOOLS AND EQUIPMENT**

MODULE TITLE : **MAINTAINING TOOLS AND EQUIPMENT**

MODULE DESCRIPTION : This module covers the knowledge, skills and attitudes on checking condition, performing preventive maintenance and storing of tools and equipment based on the required performance standard.

NOMINAL DURATION : 12 hours

**SUMMARY OF LEARNING OUTCOMES:**

Upon completion of the module the trainees/student should be able to:

LO1. Check condition of tools and equipments.

LO2. Perform basic preventive maintenance

LO3. Store tools and equipment.

## **LO1. CHECK CONDITIONS OF TOOLS AND EQUIPMENTS**

### **ASSESSMENT CRITERIA:**

1. Tools and equipment are identified according to classification/specification and job requirements.
2. Non-functional tools and equipment are segregated and labeled according to classification
3. Safety of tools and equipment are observed in accordance with manufacturer's instructions
4. Conditions of PPE are checked in accordance with manufacturer's instructions.

### **CONTENTS:**

- Types of Tools and Equipments
- Classification of functional and non-functional tools
- Uses of Personal Protective Equipment (PPE).

### **CONDITIONS:**

Students/trainees must be provided with the following:

- Classroom for discussion
- Workplace Location
- Tools and equipment related to the ffg:
  - Electrical supplies
  - Structural
  - Plumbing
  - Welding/pipefitting
  - Carpentry
  - Masonry
  - Heavy Equipment Tools for repair
- Measuring instruments/equipments
- Instructional materials
  - Handouts
  - Power Point Presentations

### **METHODOLOGIES:**

- Lecture - demonstration
- Self-paced instruction
- Group discussion

### **ASSESSMENT METHODS:**

- Oral questioning
- Direct observation
- Written test

## **LO2. PERFORM BASIC PREVENTIVE MAINTENANCE**

### **ASSESSMENT CRITERIA:**

1. Lubricants are identified according to types of equipment.
2. Tools and equipment are lubricated according to preventive maintenance schedule or manufacturer's specifications.
3. Measuring instruments are checked and calibrated in accordance with manufacturer's instructions.
4. Tools are cleaned and lubricated according to standard procedures
5. Defective equipment and tools are inspected and replaced according to manufacturer's specification.
6. Work place is cleaned and kept in safe state in line with OSHC regulations.

### **CONTENTS:**

- Types uses of lubricants
- Types and uses of cleaning materials/solvent
- Types and uses of measuring instruments and equipment.
- Preventive maintenance techniques and procedures.
- OSHC workplace regulations

### **CONDITIONS:**

Students/trainees must be provided with the following:

- Classroom for discussion
- Workplace Location
- Kinds of Manuals:
  - Manufacturer's Specification Manual
  - Repair Manual
  - Maintenance Procedure Manual
  - Periodic Maintenance Manual
- Maintenance schedule forms
- Handouts/Instructional Materials
- Maintenance materials, tools and equipment relevant to the proposed activity/task.
  - Lubricants
  - Cleaning materials
  - Rust remover
  - Rags
  - Spare parts
- PPE
  - Goggles
  - Gloves
  - Safety shoes
  - Aprons/Coveralls

#### METHODOLOGIES:

- Lecture - demonstration
- Self-paced instruction
- Group discussion

#### ASSESSMENT METHODS:

- Oral questioning
- Direct observation
- Written test

### **LO3. STORE TOOLS AND EQUIPMENT**

#### **ASSESSMENT CRITERIA:**

1. Inventory of tools, instruments, and equipment are conducted and recorded as per company practices.
2. Tools are inspected, and replaced after use.
3. Tools and equipment are stored safely in accordance with manufacturer's specifications or company procedures.

#### **CONTENTS:**

- Inventory of tools and equipment
- Tools and Equipment Handling
- Tool safe-keeping/storage

#### **CONDITIONS:**

Students/trainees must be provided with the following:

- Classroom for discussion
- Handouts/Instructional Materials
- Workplace Location/Tool Room
  - Rack
  - Tool Box
- Forms
  - Requisition Slip
  - Inventory Form
  - Inspection Form

#### **METHODOLOGIES:**

- Demonstration
- Classroom discussions

#### **ASSESSMENT METHODS:**

- Practical exam
- Direct observation
- Written test/questioning

UNIT OF COMPETENCY : **OBSERVE PROCEDURES, SPECIFICATIONS AND MANUALS OF INSTRUCTIONS**

MODULE TITLE : **OBSERVE PROCEDURES, SPECIFICATIONS AND MANUALS OF INSTRUCTIONS**

MODULE DESCRIPTION : This module covers the knowledge, skills and attitudes on identifying, interpreting, applying services to specifications and manuals and storing manuals.

NOMINAL DURATION : 8 hours

SUMMARY OF LEARNING OUTCOMES :

Upon completion of the module the trainees/student should be able to:

LO1. Identify, access, and interpret specification/manuals.

LO2. Apply information in manual.

LO3. Store manuals

## **LO1. IDENTIFY, ACCESS, AND INTERPRET SPECIFICATION/MANUALS**

### **ASSESSMENT CRITERIA:**

1. Manuals are identified and accessed as per job requirements.
2. Version and date of manual are checked to ensure that correct specification and procedures are identified.
3. Relevant sections, chapters of specifications/manuals are located in relation to the work to be conducted.
4. Information and procedure in the manual are interpreted in accordance with industry practices.

### **CONTENTS:**

- Types of manuals used in construction sector
- Different types of symbols.
- Accessing information and data.

### **CONDITIONS:**

Students/trainees must be provided with the following:

- Classroom for discussion
- Manuals/catalogues relative to construction sector.
- Instructional materials

### **METHODOLOGIES:**

- Classroom discussions / lecture
- Self-paced

### **ASSESSMENT METHODS:**

- Practical exam
- Oral exam
- Written test / questioning



## **LO2. APPLY INFORMATION IN MANUAL**

### **ASSESSMENT CRITERIA:**

1. Work steps are correctly identified in accordance with manufacturer's specification.
2. Manual data are applied according to the given task.
3. Adjustments are interpreted in accordance with information contained on the manual or specifications.

### **CONTENT:**

- Manual/specification application.

### **CONDITIONS:**

Students/trainees must be provided with the following:

- Classroom for discussion
- Manuals
- Workplace Location
- Measuring Instruments
  - Engineer's transit
  - Tape Measure
  - Feeler gauge
- Instructional materials

### **METHODOLOGIES:**

- Demonstration
- Classroom discussions
- Self-paced

### **ASSESSMENT METHODS:**

- Practical exam
- Oral exam
- Written test / questioning

### **LO3. STORE MANUAL**

#### **ASSESSMENT CRITERION:**

1. Manual or specification is stored appropriately to prevent damage, ready access and updating of information when required in accordance with company requirements.

#### **CONTENT:**

- Manual Handling

#### **CONDITIONS:**

Students/trainees must be provided with the following:

- Classroom for discussion.
- Manuals
- Store Rooms/Library
- Instructional materials

#### **METHODOLOGIES:**

- Demonstration
- Classroom discussions
- Self-paced

#### **ASSESSMENT METHODS:**

- Practical exam
- Direct observation
- Written test/questioning.

UNIT OF COMPETENCY : **INTERPRET TECHNICAL DRAWINGS AND PLANS**

MODULE TITLE : **INTERPRETING TECHNICAL DRAWINGS AND PLANS**

MODULE DESCRIPTION : This module covers the knowledge, skills and attitudes on analyzing and interpreting symbols, data and work plan based on the required performance standard.

NOMINAL DURATION : 16 hours

SUMMARY OF LEARNING OUTCOMES :

Upon completion of the module the trainees/student should be able to:

LO1. Analyze signs, symbols and data.

LO2. Interpret technical drawings and plans.

## **LO1. ANALYZE SIGNS, SYMBOLS AND DATA**

### **ASSESSMENT CRITERIA:**

1. Sign, symbols, and data are identified according to job specifications.
2. Sign, symbols and data are determined according to classification or as appropriate in drawing.

### **CONTENTS:**

- Drawing symbols and signs
- Trade mathematics

### **CONDITIONS:**

Students/trainees must be provided with the following:

- Classroom for discussion
- Workplace Location
- Measuring Instruments
  - Architect/Engineer's scale
  - Tape Measure
- Blueprints of plan
  - Architectural
  - Structural
  - Electrical
  - Mechanical
  - Plumbing
- Instructional materials

### **METHODOLOGIES:**

- Demonstration
- Classroom discussions
- Self-paced

### **ASSESSMENT METHODS:**

- Practical exam
- Direct observation
- Written test/questioning

## **LO2. INTERPRET TECHNICAL DRAWINGS AND PLANS**

### **ASSESSMENT CRITERIA:**

1. Necessary tools, materials and equipment are identified according to the plan.
2. Components, assemblies or object are recognized as per job requirement.
3. Dimensions and specification are identified according to job requirements.

### **CONTENTS:**

- Basic Technical drawing
- Technical plans and Schematic Diagram
- Symbols and Abbreviations

### **CONDITIONS:**

Students/trainees must be provided with the following:

- Classroom for discussion
- Workplace Location
- Measuring Instruments
  - Architect/Engineer's scale
  - Tape Measure
- Blueprints of plan
  - Architectural
  - Structural
  - Electrical
  - Mechanical
  - Plumbing
- Instructional materials

### **METHODOLOGIES:**

- Demonstration
- Classroom discussions
- Self-paced

### **ASSESSMENT METHODS:**

- Practical exam
- Direct observation
- Written test/questioning

# **MODULES OF INSTRUCTION**

## **CORE COMPETENCIES**

### **PV SYSTEMS INSTALLATION NC III**

**SECTOR : PV INSTALLATION (CONSTRUCTION)**

**UNIT OF COMPETENCY : INSTALL PV SYSTEM**

**MODULE TITLE : INSTALLING ELECTRICAL WIRING**

**MODULE DESCRIPTOR :** This module covers the required knowledge skills and attitude in installing electrical wiring. It deals with rough-in activities, installing electrical wiring, wiring devices, and circuit protection.

**NOMINAL DURATION : 58 hours**

**QUALIFICATION LEVEL : NC II**

**SUMMARY OF LEARNING OUTCOMES:**

At the completion of this module the trainees/student must be able to:

LO1. Prepare electrical tools, materials and equipment

LO2. Read and interpret electrical diagrams

LO3. Install lighting and power circuit using electrical non-metallic conduit.

LO4. Install light and power circuit using sheathed non-metallic cable

LO5. Install light and power circuit using electrical non-metallic surface raceway.

## LO1. PREPARE ELECTRICAL TOOLS, MATERIALS AND EQUIPMENT (20 hrs)

### ASSESSMENT CRITERIA:

- Electrical tools and materials are identified and selected in line with the job specification
- Tools and equipment are used according to manufacturers specification
- Quantity and ratings of tools and materials/accessories are checked in line with the job requirements
- Damaged electrical tools, materials are segregated and reported to the person concerned in line with company standard
- Unused electrical materials are stored in line with the manufacturer's specification.
- Proper storage of electrical materials are followed in line with the company standards
- Basic hand tools are maintained in line with the manufacturer's specification.

### CONTENTS:

- Different types of materials
  - Switches
  - Fuses and circuit breakers
  - Fuse box
  - Cut out box panel boards
  - Raceways and conduits
  - Wires and cables
  - Fastening devices
  - Boxes and fittings
  - Wiring devices
- Preparing electrical tools and materials
- Selecting and using different types of electrical hand tools and materials
- Safe handling of tools
- Proper use of tools and materials
- Selecting specification and rating of electrical materials
- Maintaining and storing basic hand tools
- Materials inventory

### CONDITION:

- |   |  |
|---|--|
| <ul style="list-style-type: none"><li>• <i>Equipment</i><ul style="list-style-type: none"><li>- Simulated workplace or wiring booth</li><li>- Personal protective equipment<ul style="list-style-type: none"><li>○ Goggles</li><li>○ Gloves</li><li>○ Safety shoes</li><li>○ Face mask</li></ul></li></ul></li><li>• <i>Tools</i><ul style="list-style-type: none"><li>- Heat gun or blow torch</li><li>- Line man's pliers</li></ul></li></ul> | <ul style="list-style-type: none"><li>• <i>Supplies and materials</i><ul style="list-style-type: none"><li>- Electrical plans/diagrams</li><li>- Electrical nonmetallic conduit</li><li>- Electrical non metallic molding</li><li>- Sheathed non metallic cable</li><li>- Fastening devices<ul style="list-style-type: none"><li>○ Wire staple</li><li>○ Wire clamps</li><li>○ Screw</li></ul></li><li>- Junction box</li><li>- Utility box</li><li>- Fuse box</li><li>- Cut out box</li></ul></li></ul> |
|---|--|



- Diagonal cutting pliers
- Long nose pliers
- Multi grip pliers
- Bar level
- Pull and push rule
- Claw hammer
- Ball peen hammer
- Chalk line reel
- Plum bob
- Screw driver
- Gimlet

- Panel box
- Electrical wires
- Electrical tape
- Circuit protection
- Wiring devices
  - Surface type
  - Flush type
- *Learning Materials*
  - Learning elements
  - Books, manuals, and catalogs
  - Philippine Electrical Code

#### METHODOLOGIES:

- Demonstration
- Lecture-discussion
- Case study

#### ASSESSMENT METHODS:

- Written examination
- Interview/oral questioning
- Demonstration

## **LO2. READ AND INTERPRET CIRCUIT DIAGRAMS, ELECTRICAL PLANS AND SYMBOLS (8 hrs)**

### **ASSESSMENT CRITERIA:**

- Electrical symbols are identified as used in the plan
- Circuit diagrams are interpreted in line with job requirement

### **CONTENTS:**

- Electrical symbols
- Different types of circuit diagrams
  - Schematic diagrams
  - Wiring diagrams
- Diagramming
  - Lamp controlled in location (one-way switch)
  - Lamp controlled in two different location (three-way switch)
  - Lamp controlled in three different location (four-way switch)
  - Other circuit diagramming exercises
- Interpreting circuit diagrams and electrical plans

### **CONDITION:**

- Materials
  - Electrical plans
- Learning Materials
  - Learning elements
  - Modules
  - Books, manuals, and catalogs
  - Philippine Electrical Code

### **METHODOLOGIES:**

- Demonstration
- Lecture-discussion
- Case study

### **ASSESSMENT METHODS:**

- Written examination
- Interview/oral questioning
- Demonstration

### LO3. INSTALL LIGHTING AND POWER CIRCUIT USING ELECTRICAL NON-METALLIC CONDUIT (16 hrs)

#### ASSESSMENT CRITERIA:

- Electrical circuit using nonmetallic conduit is installed in line with the job requirements
- Electrical circuit using nonmetallic conduit is installed in accordance with the latest provision of Philippine electrical Code
- Safety procedures in installing electrical circuit are strictly followed in line with Occupational Health and Safety procedures.

#### CONTENTS:

- Roughing-in activities using electrical non-metallic conduit.
- Method of anchoring electrical materials in metal, wood and concrete
- Installing electrical wiring using PVC
- Electrical non metallic conduit
  - PEC requirements in using PVC
  - PVC conduits and its associated fittings
  - Bending PVC
    - Elbow
    - Square saddle
    - Round saddle
    - Offset bend
- Installing wiring devices
  - Installing flush type switches and convenience outlet
- Safety procedures in installing electrical wiring using electrical nonmetallic conduit

#### CONDITION:

- |  |  |
|--|--|
| <ul style="list-style-type: none"><li>• <i>Equipment</i><ul style="list-style-type: none"><li>- Simulated workplace or wiring booth</li><li>- Personal protective equipment<ul style="list-style-type: none"><li>○ Goggles</li><li>○ Gloves</li><li>○ Safety shoes</li></ul></li></ul></li><li>• <i>Tools</i><ul style="list-style-type: none"><li>- Heat gun or blow torch</li><li>- Line man's pliers</li><li>- Diagonal cutting pliers</li><li>- Long nose pliers</li><li>- Bar level</li><li>- Pull and push rule</li><li>- Claw hammer</li><li>- Ball peen hammer</li><li>- Chalk line reel</li><li>- Screw driver</li><li>- Gimlet</li></ul></li></ul> | <ul style="list-style-type: none"><li>• <i>Supplies and materials</i><ul style="list-style-type: none"><li>- Electrical plans/diagrams</li><li>- Electrical nonmetallic conduit</li><li>- Fastening devices<ul style="list-style-type: none"><li>○ Wire staple</li><li>○ Wire clamps</li><li>○ Screw</li></ul></li><li>- Junction box</li><li>- Utility box</li><li>- Electrical wires</li><li>- Electrical tape</li><li>- Switches</li></ul></li><li>• <i>Learning Materials</i><ul style="list-style-type: none"><li>- Learning elements</li><li>- Books, manuals, and catalogs</li><li>- Philippine Electrical Code</li></ul></li></ul> |
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#### METHODOLOGIES:

- Demonstration
- Lecture-discussion

#### ASSESSMENT METHODS:

- Interview/oral questioning
- Demonstration

#### **LO4. INSTALL LIGHT AND POWER CIRCUIT USING SHEATHED NON-METALLIC CABLE (8 hrs)**

##### **ASSESSMENT CRITERIA:**

- Electrical circuit using sheathed nonmetallic cable is installed in line with the job requirements.
- Electrical circuit using sheathed nonmetallic cable is installed in accordance with the latest provision of Philippine electrical Code
- Safety procedures in installing electrical circuit are strictly followed in line with Occupational Health and Safety procedures.

##### **CONTENTS:**

- Safety procedures in installing electrical wiring using sheathed nonmetallic cable
- Installing electrical wiring using sheathed nonmetallic cable
- Roughing-in activities using sheathed nonmetallic.
- Installing wiring devices
  - Surface type switches and convenience outlet.
- Sheathed nonmetallic cable
  - PEC requirements in using sheathed nonmetallic cable

##### **CONDITION:**

- |   |  |
|---|--|
| <ul style="list-style-type: none"><li>• <i>Equipment</i><ul style="list-style-type: none"><li>- Simulated workplace or wiring booth</li><li>- Personal protective equipment<ul style="list-style-type: none"><li>○ Goggles</li><li>○ Gloves</li><li>○ Safety shoes</li></ul></li></ul></li><li>• <i>Tools</i><ul style="list-style-type: none"><li>- Line man's pliers</li><li>- Diagonal cutting pliers</li><li>- Long nose pliers</li><li>- Bar level</li><li>- Pull and push rule</li><li>- Claw hammer</li><li>- Ball peen hammer</li><li>- Chalk line reel</li><li>- Screw driver</li><li>- Gimlet</li></ul></li></ul> | <ul style="list-style-type: none"><li>• <i>Supplies and materials</i><ul style="list-style-type: none"><li>- Electrical plans/diagrams</li><li>- Sheathed nonmetallic cable</li><li>- Fastening devices<ul style="list-style-type: none"><li>○ Wire staple</li><li>○ Wire clamps</li><li>○ Screw</li></ul></li><li>- Junction box</li><li>- Utility box</li><li>- Electrical wires</li><li>- Electrical tape</li><li>- Switches</li></ul></li><li>• <i>Learning Materials</i><ul style="list-style-type: none"><li>- Learning elements</li><li>- Books, manuals, and catalogs</li><li>- Philippine Electrical Code</li></ul></li></ul> |
|---|--|

##### **METHODOLOGIES:**

- Demonstration
- Lecture-discussion

##### **ASSESSMENT METHODS:**

- Interview/oral questioning
- Demonstration

## LO5. INSTALL LIGHT AND POWER CIRCUIT USING ELECTRICAL NON-METALLIC SURFACE RACEWAY (6 hrs)

### ASSESSMENT CRITERIA:

- Electrical circuit using nonmetallic surface raceway is installed in line with the job requirements.
- Electrical circuit using nonmetallic surface raceway is installed in accordance with the latest provision of Philippine electrical Code
- Safety procedures in installing electrical circuit are strictly followed in line with Occupational Health and Safety procedures.

### CONTENTS:

- Installing electrical wiring using nonmetallic surface raceway Roughing-in activities using nonmetallic surface raceway
- Installing wiring devices
- Sheathed nonmetallic cable
  - PEC requirements in using nonmetallic raceway
- Safety procedures in installing electrical wiring using surface nonmetallic raceway.

### CONDITION:

- |   |   |
|---|---|
| <ul style="list-style-type: none"><li>• <i>Equipment</i><ul style="list-style-type: none"><li>- Simulated workplace or wiring booth</li><li>- Personal protective equipment<ul style="list-style-type: none"><li>○ Goggles</li><li>○ Gloves</li><li>○ Safety shoes</li></ul></li></ul></li><li>• <i>Tools</i><ul style="list-style-type: none"><li>- Line man's pliers</li><li>- Diagonal cutting pliers</li><li>- Long nose pliers</li><li>- Bar level</li><li>- Pull and push rule</li><li>- Claw hammer</li><li>- Ball peen hammer</li><li>- Chalk line reel</li><li>- Screw driver</li><li>- Gimlet</li></ul></li></ul> | <ul style="list-style-type: none"><li>• <i>Supplies and materials</i><ul style="list-style-type: none"><li>- Electrical plans/diagrams</li><li>- Surface nonmetallic raceway</li><li>- Fastening devices<ul style="list-style-type: none"><li>○ Screw</li></ul></li><li>- Junction box</li><li>- Utility box</li><li>- Electrical wires</li><li>- Electrical tape</li><li>- Switches</li></ul></li><li>• <i>Learning Materials</i><ul style="list-style-type: none"><li>- Learning elements</li><li>- Books, manuals, and catalogs</li><li>- Philippine Electrical Code</li></ul></li></ul> |
|---|---|

### METHODOLOGIES:

- Demonstration
- Lecture-discussion

### ASSESSMENT METHODS:

- Interview/oral questioning
- Demonstration

SECTOR : **PV INSTALLATION (CONSTRUCTION)**

UNIT OF COMPETENCY : **PERFORM PV SYSTEM TESTING AND COMMISSIONING**

MODULE TITLE : **PERFORMING PV SYSTEM TESTING AND COMMISSIONING**

MODULE DESCRIPTOR : This module covers the skills, knowledge, and attitude in performing PV System Testing and Commissioning

NOMINAL DURATION : 24 hours

QUALIFICATION LEVEL : NC III

PREREQUISITE : PV Installation NC II

**SUMMARY OF LEARNING OUTCOMES:**

Upon completion of this module, the trainee/student must be able to:

- LO1. Prepare to commission PV system
- LO2. Commission PV system
- LO3. Inspect and notify completion of work

## **LO1. PREPARE TO COMMISSION PV SYSTEM (4 hrs)**

### **ASSESSMENT CRITERIA:**

- Work instructions are validated to ensure clear understanding of job requirements
- Commissioning procedures are planned according to manufacturer's instructions and job order requirements
- Personal Protective Equipment needed to complete job order requirements are obtained according to established procedures
- Tools, measuring instruments and materials needed for commissioning are obtained according to established procedures

### **CONTENTS:**

- PV system and individual components functionality and standard operating ranges
- Planning for commissioning of PV systems
- Identifying tools, test instruments, and materials for commissioning
- Awareness of local conditions

### **CONDITIONS:**

Students/trainees must be provided with the following:

- Site conditions and location map template
- Forms:
  - Electrical installation drawings
  - Installation data sheet

### **METHODOLOGIES:**

- Lecture-demonstration
- Self-paced instruction
- Group discussion

### **ASSESSMENT METHODS:**

- Observation with questioning
- Written/oral examination



## **LO2. COMMISSION PV SYSTEM (16 hours)**

### **ASSESSMENT CRITERIA:**

- Individual components and the whole system are checked if operational and are installed according to established procedures and job order requirements
- Corrective measures or rectifications on the installation are made in line with established procedures
- Occupational health and safety procedures are followed during commissioning

### **CONTENTS:**

- Interpreting electrical drawings
- Commissioning procedures for PV systems
- Use and proper handling of tools, test instruments, and materials for commissioning
- Common system/equipment malfunctions and basic corrective and rectification techniques
- Occupational health and safety standards
- PEC requirements

### **CONDITIONS:**

Students/trainees must be provided with the following:

- Installed PV system
- Tools, measuring instruments, and materials
  - Tools
    - Screwdrivers
    - Pliers
    - Wrenches
    - Electrician's knife
    - Ladder/scaffolding
    - Magnetic compass
    - Spirit level
  - Measuring instruments
    - Clamp meter
    - Multimeter
    - Hydrometer
  - Materials
    - Wires and cables
    - Connectors
    - Clamps
    - Electrical tape
    - Battery grease
    - Fuse
    - Diodes
    - Staple wires, screws, and nails
    - Asphalt/sealant (if needed)
    - Distilled water
    - Bolts and nuts

- Forms and documents
  - Electrical installation sketch
  - Installation data sheet
  - Commissioning document

#### METHODOLOGIES:

- Lecture-demonstration
- Self-paced instruction
- Group discussion

#### ASSESSMENT METHODS:

- Direct observation with questions
- Demonstration with questions
- Oral/written examination
- Third party report

### **LO3. INSPECT AND NOTIFY COMPLETION OF WORK (4 hours)**

#### **ASSESSMENT CRITERIA:**

- Final inspection is undertaken to ensure that commissioning of PV system meets customers' requirements
- Commissioning document is accomplished and written report is prepared using standard company procedures
- Customer are notified upon work completion in accordance with the established procedure
- Proper housekeeping is observed and practiced in accordance with occupational health and safety standards

#### **CONTENTS:**

- Features of a commissioning document
- Proper filling-out of the commissioning document

#### **CONDITIONS:**

Students/trainees must be provided with the following:

- Commissioning document
- Installation data sheet
- Housekeeping paraphernalia

#### **METHODOLOGIES:**

- Lecture-demonstration
- Self-paced instruction
- Group discussion

#### **ASSESSMENT METHODS:**

- Direct observation with questions
- Oral/written examination

## 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.

*These materials are available in both printed and electronic copies.*

*For more information please contact:*

**Technical Education and Skills Development Authority (TESDA)**

*Telephone Nos.: 893-8281, 817-4076 to 82 loc. 611 to 630, 631 and 635 or visit our website: [www.tesda.gov.ph](http://www.tesda.gov.ph)*

*or the TESDA Regional or Provincial Office nearest you.*

