TRAINING REGULATIONS

ELECTRICAL INSTALLATION AND MAINTENANCE NC III

ELECTRICAL & ELECTRONICS SECTOR

TECHNICAL EDUCATION AND SKILLS DEVELOPMENT AUTHORITY
East Service Road, South Luzon Expressway, Taguig City, Metro Manila

Technical Education and Skills Development Act of 1994
(Republic Act No. 7796)

Section 22, "Establishment and Administration of the National Trade Skills Standards" of the RA 7796 known as the TESDA Act mandates TESDA to establish national occupational skill standards. The Authority shall develop and implement a certification and accreditation program in which private industry group and trade associations are accredited to conduct approved trade tests, and the local government units to promote such trade testing activities in their respective areas in accordance with the guidelines to be set by the Authority.

The Training Regulations (TR) serve as basis for the:

1. Competency assessment and certification;
2. Registration and delivery of training programs; and
3. Development of curriculum and assessment instruments.

Each TR has four sections:

Section 1 Definition of Qualification - refers to the group of competencies that describes the different functions of the qualification.

Section 2 Competency Standards - gives the specifications of competencies required for effective work performance.

Section 3 Training Standards - contains information and requirements in designing training program for certain Qualification. It includes curriculum design; training delivery; trainee entry requirements; tools, equipment and materials; training facilities; trainer's qualification; and institutional assessment.

Section 4 National Assessment and Certification Arrangement - describes the policies governing assessment and certification procedure

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SECTION 1. THE ELECTRICAL INSTALLATION & MAINTENANCE NC III QUALIFICATION

The Electrical Installation & Maintenance NC III qualification consists of a set of competencies that a candidate for this qualification must achieve in order to obtain a national certificate for this qualification as specified by TESDA requirements. This particular set of competencies excludes core technical competencies required for related highly specialized vocational skilled workers such as linemen, substation technicians, electrical motors/generators repair technicians, etc..

Required units of Competency. The list of required units of competency for this qualification are summarized herein and are in detailed in Section 2:

Code No	Basic Units of Competency
500311109	Lead workplace communication
500311110	Lead small teams
500311111	Develop and practice negotiating skills
500311112	Sove problems related to work activities
500311113	Use mathematical concepts and techniques
500311114	Use relevant technologies

Code No	Common Units of Competency
ELC311205	Use Hand Tools
ELC311201	Perform Mensuration and Calculation
ELC311202	Prepare and Interpret Technical Drawing
ELC311204	Apply Quality Standards
ELC311206	Terminate and Connect Electrical Wiring and Electronic Circuits
ELC311212	Maintain tools and equipment

Code No	Core Units of Competency
ELC741304	Perform roughing-in and wiring activities for three-phase distribution system for power, lighting and motor control panel.
ELC741305	Perform installation of data measurement and control system on electrical and auxiliary equipment
ELC741306	Install, assemble, test and maintain motor control system.

A candidate who has achieved all these competencies is qualified to be:

a. Industrial Electrician

b. Electrical Leadman, or

c. Electrical Foreman

SECTION 2. COMPETENCY STANDARDS

This section gives the details of the contents of the units of competency required in ELECTRICAL INSTALLATION & MAINTENANCE NC III. These units of competency are categorized into basic, common and core competencies.

BASIC COMPETENCIES

UNIT OF COMPETENCY : LEAD WORKPLACE COMMUNICATION

UNIT CODE : 500311109

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes required to lead in the dissemination and discussion of ideas, information and issues in the workplace.

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Communicate information about workplace processes	1.1. Appropriate ***communication method*** is selected 1.2. Multiple operations involving several topics areas are communicated accordingly 1.3. Questions are used to gain extra information 1.4. Correct sources of information are identified 1.5. Information is selected and organized correctly 1.6. Verbal and written reporting is undertaken when required 1.7. Communication skills are maintained in all situations	• Organization requirements for written and electronic communication methods • Effective verbal communication methods • Methods of Communication • Types of Question • Communication Tools • Questioning Techniques	• Organizing information • Understanding and conveying intended meaning • Participating in variety of workplace discussions • Complying with organization requirements for the use of written and electronic communication methods • Reporting occupational hazards during safety meeting
2. Lead workplace discussions	2.1. Response to workplace issues are sought 2.2. Response to workplace issues are provided immediately 2.3. Constructive contributions are made to workplace discussions on such issues as production, quality and safety 2.4. Goals/objectives and action plan are undertaken in the workplace are communicated	• Leading as a management function • Barriers of communication • Effective verbal communication methods • Methods/ techniques of discussion • How to lead discussion • How to solicit response • Goal setting and action planning	• Communicating effectively • Consulting the crew on the prepared menu for the month

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
3. Identify and communicate issues arising in the workplace	3.1 Issues and problems are identified as they arise 3.2 Information regarding problems and issues are organized coherently to ensure clear and effective communication 3.3 Dialogue is initiated with appropriate personnel 3.4 Communication problems and issues are raised as they arise	• Types of issues and problems in the workplace • Written and electronic communication methods • Communication barriers affecting workplace discussions	• Identifying cause of problems • Identifying problems and issues • Organizing information on problems and issues • Relating problems and issues in the workplace

RANGE OF VARIABLES

VARIABLE	RANGE
1. Methods of communication	1.1. Non-verbal gestures 1.2. Verbal 1.3. Face to face 1.4. Two-way radio 1.5. Speaking to groups 1.6. Using telephone 1.7. Written 1.8. Internet

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1. Dealt with a range of communication/information at one time 1.2. Made constructive contributions in workplace issues 1.3. Sought workplace issues effectively 1.4. Responded to workplace issues promptly 1.5. Presented information clearly and effectively written form 1.6. Used appropriate sources of information 1.7. Asked appropriate questions 1.8. Provided accurate information
2. Resource Implications	The following resources MUST be provided: 2.1. Variety of Information 2.2. Communication tools 2.3. Simulated workplace
3. Methods of Assessment	Competency may be assessed through: 3.1. Competency in this unit must be assessed through 3.2. Direct Observation 3.3. Interview
4. Context for Assessment	Competency may be assessed in the workplace or in simulated workplace environment

UNIT OF COMPETENCY : LEAD SMALL TEAMS
UNIT CODE : 500311110
UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes to lead small teams including setting and maintaining team and individual performance standards.

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Provide team leadership	1.1. ***Work requirements*** are identified and presented to team members 1.2. Reasons for instructions and requirements are communicated to team members 1.3. ***Team members' queries and concerns*** are recognized, discussed and dealt with	• Company policies and procedures • How performance expectations are set • Methods of Monitoring Performance • Client expectations • Team member's duties and responsibilities • Definition of Team • Skills and techniques in promoting team building • Up-to-date dissemination of instructions and requirements to members • Art of listening and treating individual team members concern	• Communication skills required for leading teams • Team building skills • Negotiating skills • Evaluation skills
2. Assign responsibilities	2.1 Duties and responsibilities are allocated having regard to the skills, knowledge and aptitude required to properly undertake the assigned task and according to company policy 2.2 Duties are allocated having regard to individual preference, domestic and personal considerations, whenever possible	• Concept of delegation • How to delegate • Understanding individual differences • Methods of monitoring performance • Duties and responsibilities of each team member • Knowledge in identifying each team member duties and responsibilities	• Delegating skills • Identifying individual skills, knowledge and attitude as basis for allocating responsibilities • Identifying each team member duties and responsibilities
3. Set performance expectations for team members	3.1 Performance expectations are established based on client needs and according to assignment requirements 3.2 Performance expectations are based on individual team members duties and area of responsibility	• Definition of performance indicators/ criteria • Definition of team goals and expectations • Methods of monitoring performance • Client expectations	• Identifying performance indicators • Evaluating performance • Setting individual performance target/ expectation

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	3.3 Performance expectations are discussed and disseminated to individual team members	• Team members duties and responsibilities • Defining performance expectations criteria	indicators
4. Supervise team performance	4.1 ***Monitoring of performance*** takes place against defined performance criteria and/or assignment instructions and corrective action taken if required 4.2 Team members are provided with ***feedback***, positive support and advice on strategies to overcome any deficiencies 4.3 ***Performance issues*** which cannot be rectified or addressed within the team are referenced to appropriate personnel according to employer policy 4.4 Team members are kept informed of any changes in the priority allocated to assignments or tasks which might impact on client/customer needs and satisfaction 4.5 Team operations are monitored to ensure that employer/client needs and requirements are met 4.6 Follow-up communication is provided on all issues affecting the team 4.7 All relevant documentation is completed in accordance with company procedures	• Understanding Monitoring of work • How to undertake corrective action • Understanding feedback and procedure • Feedback reporting procedure • Methods of monitoring performance • Team member's duties and responsibilities • Monitoring team operation to ensure client needs and satisfaction	• Monitoring skills • Setting priorities • Evaluating performance • Informal/ formal counseling skills

RANGE OF VARIABLES

VARIABLE	RANGE
1. Work requirements	1.1. Client Profile 1.2. Assignment instructions
2. Team member's concerns	2.1. Roster/shift details
3. Monitor performance	3.1. Formal process 3.2. Informal process
4. Feedback	4.1. Formal process 4.2. Informal process
5. Performance issues	5.1. Work output 5.2. Work quality 5.3. Team participation 5.4. Compliance with workplace protocols 5.5. Safety 5.6. Customer service

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1. Maintained or improved individuals and/or team performance given a variety of possible scenario 1.2. Assessed and monitored team and individual performance against set criteria 1.3. Represented concerns of a team and individual to next level of management or appropriate specialist and to negotiate on their behalf 1.4. Allocated duties and responsibilities, having regard to individual's knowledge, skills and aptitude and the needs of the tasks to be performed 1.5. Set and communicated performance expectations for a range of tasks and duties within the team and provided feedback to team members
2. Resource Implications	The following resources MUST be provided: 2.1. Access to relevant workplace or appropriately simulated environment where assessment can take place 2.2. Materials relevant to the proposed activity or task
3. Methods of Assessment	Competency may be assessed through: 3.1. Direct observations of work activities of the individual member in relation to the work activities of the group 3.2. Observation of simulation and/or role play involving the participation of individual member to the attainment of organizational goal 3.3. Case studies and scenarios as a basis for discussion of issues and strategies in teamwork
4. Context for Assessment	4.1. Competency assessment may occur in workplace or any appropriately simulated environment 4.2. Assessment shall be observed while task are being undertaken whether individually or in-group

UNIT OF COMPETENCY: DEVELOP AND PRACTICE NEGOTIATION SKILLS

UNIT CODE : 500311111

UNIT DESCRIPTOR : This unit covers the skills, knowledge and attitudes required to collect information in order to negotiate to a desired outcome and participate in the negotiation.

ELEMENT	PERFORMANCE CRITERIA Italicized terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Plan negotiations	1.1 Information on ***preparing for negotiation*** is identified and included in the plan 1.2 Information on creating ***nonverbal environments*** for positive negotiating is identified and included in the plan 1.3 Information on ***active listening*** is identified and included in the plan 1.4 Information on different ***questioning techniques*** is identified and included in the plan 1.5 Information is checked to ensure it is correct and up-to- date	• Knowledge on Codes of practice and guidelines for the organization • Knowledge of organizations policy and procedures for negotiations • Decision making and conflict resolution strategies procedures • Concept of negotiation	• Communication skills (verbal and listening) • Active listening • Setting conflict • Preparing conflict resolution • Problem solving strategies on how to deal with unexpected questions and attitudes during negotiation • Interpersonal skills to develop rapport with other parties
2. Participate in negotiations	2.1 Criteria for successful outcome are agreed upon by all parties 2.2 Desired outcome of all parties are considered 2.3 Appropriate language is used throughout the negotiation 2.4 A variety of questioning techniques are used 2.5 The issues and processes are documented and agreed upon by all parties 2.6 Possible solutions are discussed and their viability assessed 2.7 Areas for agreement are confirmed and recorded 2.8 Follow-up action is agreed upon by all parties	• Outcome of negotiation • Knowledge on Language • Different Questioning techniques • Problem solving strategies on how to deal with unexpected questions and attitudes during negotiation	• Negotiating skill • Communication skills (verbal and listening) • Observation skills • Interpersonal skills to develop rapport with other parties • Applying effective questioning techniques • Setting conflict

RANGE OF VARIABLES

VARIABLE	RANGE
1. Preparing for negotiation	1.1 Background information on other parties to the negotiation 1.2 Good understanding of topic to be negotiated 1.3 Clear understanding of desired outcome/s 1.4 Personal attributes 1.4.1 self awareness 1.4.2 self esteem 1.4.3 objectivity 1.4.4 empathy 1.4.5 respect for others 1.5 Interpersonal skills 1.5.1 listening/reflecting 1.5.2 non verbal communication 1.5.3 assertiveness 1.5.4 behavior labeling 1.5.5 testing understanding 1.5.6 seeking information 1.5.7 self disclosing 1.6 Analytic skills 1.6.1 observing differences between content and process 1.6.2 identifying bargaining information 1.6.3 applying strategies to manage process 1.6.4 applying steps in negotiating process 1.6.5 strategies to manage conflict 1.6.6 steps in negotiating process 1.6.7 options within organization and externally for resolving conflict
2. Non verbal environments	2.1 Friendly reception 2.2 Warm and welcoming room 2.3 Refreshments offered 2.4 Lead in conversation before negotiation begins
3. Active listening	3.1 Attentive 3.2 Don't interrupt 3.3 Good posture 3.4 Maintain eye contact 3.5 Reflective listening
4. Questioning techniques	4.1 Direct 4.2 Indirect 4.3 Open-ended

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Demonstrated sufficient knowledge of the factors influencing negotiation to achieve agreed outcome 1.2 Participated in negotiation with at least one person to achieve an agreed outcome
2. Resource Implications	The following resources MUST be provided: 2.1 Room with facilities necessary for the negotiation process 2.2 Human resources (negotiators)
3. Methods of Assessment	Competency may be assessed through: 3.1 Observation/demonstration and questioning 3.2 Portfolio assessment 3.3 Oral and written questioning 3.4 Third party report
4. Context for Assessment	Competency to be assessed in real work environment or in a simulated workplace setting.

UNIT OF COMPETENCY : SOLVE PROBLEMS RELATED TO WORK ACTIVITIES

UNIT CODE : 500311112

UNIT DESCRIPTOR : This unit of covers the knowledge, skills and attitudes required to solve problems in the workplace including the application of problem solving techniques and to determine and resolve the root cause of problems.

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Identify the problem	1.1. Variances are identified from normal operating parameters; and product quality 1.2. Extent, cause and nature of the problem are defined through observation, investigation and ***analytical techniques*** 1.3. ***Problems*** are clearly stated and specified	• Competence includes a thorough knowledge and understanding of the process, normal operating parameters, and product quality to recognize non-standard situations • Competence to include the ability to apply and explain, sufficient for the identification of fundamental cause, determining the corrective action and provision of recommendations o Relevant equipment and operational processes o Enterprise goals, targets and measures o Enterprise quality, OHS and environmental requirement o Enterprise information systems and data collation o Industry codes and standards • Normal operating parameters and product quality • Identifying and clarifying the nature of problem	• Using range of formal problem solving techniques • Identifying and clarifying the nature of the problem • Evaluating the effectiveness of a present process in the workplace • Applying analytical techniques
2. Determine fundamental causes of the problem	2.1 Possible causes are identified based on experience and the use of problem solving tools/ analytical techniques. 2.2 Possible cause statements are developed based on findings 2.3 Fundamental causes are identified per results of investigation conducted	• Relevant equipment and operational processes • Enterprise goals, targets and measures • Enterprise quality, OHS and environmental requirements • Enterprise information systems and data collation • Industry codes and standards	• Analysis of root causes

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
3. Determine corrective action	3.1 All possible options are considered for resolution of the problem 3.2 Strengths and weaknesses of possible options are considered 3.3 Corrective actions are determined to resolve the problem and possible future causes 3.4 **Action *plans*** are developed identifying measurable objectives, resource needs and timelines in accordance with safety and operating procedures	• Understanding the procedure in undertaking corrective action • Principles of decision making strategies and techniques • Enterprise information systems and data collation • Action planning	• Identifying and clarifying the nature of the problem • Devising the best solution • Evaluating the solution • Implementing developed plan to rectify the problem • Implementing corrective and preventive actions based on root cause analysis
4. Provide recommendation/s to manager	4.1 Report on recommendations are prepared according to procedures. 4.2 Recommendations are presented to appropriate personnel. 4.3 Recommendations are followed-up, if required	• How to make a report and recommendation	• Writing report and recommendations

RANGE OF VARIABLES

VARIABLE	RANGE
1. Analytical techniques	1.1. Brainstorming 1.2. Intuitions/Logic 1.3. Cause and effect diagrams 1.4. Pareto analysis 1.5. SWOT analysis 1.6. Gant chart, Pert CPM and graphs 1.7. Scattergrams
2. Problem	2.1. Non – routine process and quality problems 2.2. Equipment selection, availability and failure 2.3. Teamwork and work allocation problem 2.4. Safety and emergency situations and incidents
3. Action plans	3.1. Priority requirements 3.2. Measurable objectives 3.3. Resource requirements 3.4. Timelines 3.5. Co-ordination and feedback requirements 3.6. Safety requirements 3.7. Risk assessment 3.8. Environmental requirements

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1. Identified the problem 1.2. Determined the fundamental causes of the problem 1.3. Determined the correct / preventive action 1.4. Provided recommendation to manager These aspects may be best assessed using a range of scenarios / case studies / what ifs as a stimulus with a walk through forming part of the response. These assessment activities should include a range of problems, including new, unusual and improbable situations that may have happened.
2. Resource Implications	Assessment will require access to an operating plant over an extended period of time, or a suitable method of gathering evidence of operating ability over a range of situations. A bank of scenarios / case studies / what ifs will be required as well as bank of questions which will be used to probe the reason behind the observable action.
3. Methods of Assessment	Competency may be assessed through: 3.1. Case studies on solving problems in the workplace 3.2. Observation The unit will be assessed in a holistic manner as is practical and may be integrated with the assessment of other relevant units of competency. Assessment will occur over a range of situations, which will include disruptions to normal, smooth operation. Simulation may be required to allow for timely assessment of parts of this unit of competency. Simulation should be based on the actual workplace and will include walk through of the relevant competency components.
4. Context for Assessment	In all workplace, it may be appropriate to assess this unit concurrently with relevant teamwork or operation units.

UNIT OF COMPETENCY: USE MATHEMATICAL CONCEPTS AND TECHNIQUES
UNIT CODE : 500311113
UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes required in the application of mathematical concepts and techniques.

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Identify mathematical tools and techniques to solve problem	1.1. Problem areas are identified based on given condition 1.2. ***Mathematical techniques*** are selected based on the given problem	• Fundamental operation (addition, subtraction, division, multiplication) • Units of measurement and its conversion • Fundamental of units • Standard formulas • Basic measuring tools/devices • Measurement system • Basic measuring tools/devices • Steps in solving problem	• Identifying and selecting different measuring tools • Applying different formulas in solving problems • Describing the units of measurement and fundamental units • Stating arithmetic calculations involving the following; addition, subtraction, division, multiplication • Applying theory into actual application on shipboard catering processes
2. Apply mathematical procedure/ solution	2.1. Mathematical techniques are applied based on the problem identified 2.2. Mathematical computations are performed to the level of accuracy required for the problem 2.3. Results of mathematical computation is determined and verified based on job requirements	• Problem-based questions • Estimation • Use of mathematical tools and standard formulas • Mathematical techniques	• Solving mathematical computations • Converting Metric to English • Selecting and using appropriate and efficient techniques and strategies to solve problems
3. Analyze results	3.1 Result of application is reviewed based on expected and required specifications and outcome 3.2 ***Appropriate action*** is applied in case of error	• Techniques in analyzing the results • Process in reviewing the results • Precision and accuracy • Four fundamental operations • Steps in solving problem • Standard formulas • Conversion measurement	• Analyzing the result based on the specified requirements • Interpreting and communicating the results of the analysis

RANGE OF VARIABLES

VARIABLE	RANGE
1. Mathematical techniques	May include but are not limited to: 1.1 Four fundamental operations 1.2 Measurements 1.3 Use/Conversion of units of measurements 1.4 Use of standard formulas
2. Appropriate action	2.1 Review in the use of mathematical techniques (e.g. recalculation, re-modeling) 2.2 Report error to immediate superior for proper action

EVIDENCE GUIDE

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: Identified, applied and reviewed the use of mathematical concepts and techniques to workplace problems
2. Resource Implications	The following resources **MUST** be provided: 2.1 Calculator 2.2 Basic measuring tools 2.3 Case Problems
3. Methods of Assessment	Competency may be assessed through: 3.1 Authenticated portfolio 3.2 Written Test 3.3 Interview/Oral Questioning 3.4 Demonstration
4. Context for Assessment	Competency may be assessed in the work place or in a simulated work place setting

UNIT OF COMPETENCY: USE RELEVANT TECHNOLOGIES

UNIT CODE : 500311114

UNIT DESCRIPTOR : This unit of competency covers the knowledge, skills, and attitude required in selecting, sourcing and applying appropriate and affordable technologies in the workplace.

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Study/select appropriate technology	1.1 Usage of different ***technologies*** is determined based on job requirements 1.2 Appropriate technology is selected as per work specification	• Awareness on technology and its function • Communication techniques • Health and safety procedure • Company policy in relation to relevant technology • Machineries/ equipment and their application • Software programs	• Identifying relevant technology on job
2. Apply relevant technology	2.1 Relevant technology is effectively used in carrying out function 2.2 Applicable software and hardware are used as per task requirement 2.3 ***Management concepts*** are observed and practiced as per established industry practices	• Knowledge on operating instructions • Understanding software and hardware system • Communication techniques • Health and safety procedure • Company policy in relation to relevant technology • Different management concepts • Technology adaptability	• Applying relevant technology • Communicating skills • Using software applications skills • Conducting risk assessment
3. Maintain/ enhance relevant technology	3.1 Maintenance of technology is applied in accordance with the ***industry standard operating procedure***, ***manufacturer's operating guidelines*** and ***occupational health and safety procedure*** to ensure its operative ability 3.2 Updating of technology is maintained through continuing education or training in accordance with job requirement 3.3 Technology failure/ defect is immediately reported to the concern/responsible person or section for ***appropriate action***	• Awareness on technology and its function • Repair and maintenance procedure • Health and safety procedure • Company policy in relation to relevant technology • Upgrading of technology • Organizational set-up/work flow	• Performing basic troubleshooting skills • Identifying failures or defects • Communication skills • Applying corrective and preventive maintenance

RANGE OF VARIABLES

VARIABLE	RANGE
1. Technology	May include but are not limited to: 1.1 Office technology 1.2 Industrial technology 1.3 System technology 1.4 Information technology 1.5 Training technology
2. Management concepts	May include but not limited to: 2.1 Real Time Management 2.2 KAIZEN or continuous improvement 2.3 5s 2.4 Total Quality Management 2.5 Other management/productivity tools
3. Industry standard operating procedure	Written guidelines relative to the usage of office technology/equipment Verbal advise/instruction from the co-worker
4. Manufacturer's operating guidelines/ instructions	4.1 Written instruction/manuals of specific technology/ equipment 4.2 General instruction manual 4.3 Verbal advise from manufacturer relative to the operation of equipment
5. Occupational health and safety procedure	5.1 Relevant statutes on OHS 5.2 Company guidelines in using technology/equipment
6. Appropriate action	6.1 Implementing preventive maintenance schedule 6.2 Coordinating with manufacturer's technician

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Studied and selected appropriate technology consistent with work requirements 1.2 Applied relevant technology 1.3 Maintained and enhanced operative ability of relevant technology
2. Resource Implications	The following resources MUST be provided: 2.1 Relevant technology 2.2 Interview and demonstration questionnaires 2.3 Assessment packages
3. Methods of Assessment	Competency must be assessed through: 3.1 Interview 3.2 Actual demonstration 3.3 Authenticated portfolio (related certificates of training/seminar)
4. Context for Assessment	Competency may be assessed in actual workplace or simulated environment

COMMON COMPETENCIES

UNIT TITLE : USE HAND TOOLS
UNIT CODE : ELC311205
UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes on the safe use, handling and maintenance of tools.

ELEMENT	PERFORMANCE CRITERIA ***Italicized Bold*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Plan and prepare for tasks to be undertaken	1.1. Tasks to be undertaken are properly identified 1.2. Appropriate ***hand tools*** are identified and selected according to the task requirements	• Planning and preparing task/ activity • Electronics hand tools and their uses • Function, operation and common faults in electronics hand tools	• Preparing required tasks • Communication skills • Using hand tools properly
2. Prepare hand tools	2.1. Appropriate hand tools are checked for proper operation and safety 2.2. Unsafe or faulty tools are identified and marked for repair according to standard company procedure	• Checking and safety requirements in handling tools • Standard procedures in checking, identification and marking of safe or unsafe/ faulty tools	• Identifying and checking hand tools • Marking of safe or unsafe/ faulty hand tools
3. Use appropriate hand tools and test equipment	3.1. Tools are used according to tasks undertaken 3.2. All safety procedures in using tools are observed at all times and appropriate ***personal protective equipment*** (PPE) are used 3.3. Malfunctions, unplanned or unusual events are reported to the supervisor	• Safety requirements in using electronics hand tools and test equipment • Electronics hand tools for adjusting, dismantling, assembling, finishing, and cutting. • Processes, Operations, Systems o Proper usage and care of hand tools o Types and uses of test equipment o Common faults in the use of hand tool	• Reading skills required to interpret work instruction and numerical skills • Using PPE properly • Problem solving in emergency situation
4. Maintain hand tools	4.1. Tools are not dropped to avoid damage 4.2. Routine ***maintenance*** of tools undertaken according to standard operational procedures, principles and techniques 4.3. Tools are stored safely in appropriate locations in accordance with manufacturer's specifications or standard operating procedures	• Safety requirements in maintenance of hand tools • Processes, Operations, Systems o Maintenance of tools o Storage of hand tools	• Checking and cleaning hand tools • Storing hand tools properly

RANGE OF VARIABLES

VARIABLE	RANGE
1. Hand tools	1.1. Hand tools for adjusting, dismantling, assembling, finishing, and cutting. Tool set includes the following but not limited to: screw drivers, pliers, punches, wrenches, files
2. Personal Protective Equipment (PPE)	2.1. Gloves 2.2. Protective eyewear 2.3. Apron/overall
3. Maintenance	3.1. Cleaning 3.2. Lubricating 3.3. Tightening 3.4. Simple tool repairs 3.5. Hand sharpening 3.6. Adjustment using correct procedures

EVIDENCE GUIDE

1. Critical aspect of competency	Assessment requires evidence that the candidate: 1.1. Demonstrated safe working practices at all times 1.2. Communicated information about processes, events or tasks being undertaken to ensure a safe and efficient working environment 1.3. Planned tasks in all situations and reviewed task requirements as appropriate 1.4. Performed all tasks to specification 1.5. Maintained and stored tools in appropriate location
2. Method of assessment	Competency in this unit must be assessed through: 2.1. Observation 2.2. Oral questioning
3. Resource Implication	Tools may include the following but not limited to: 3.1. Screw drivers 3.2. Pliers 3.3. Punches 3.4. Wrenches 3.5. Files
4. Context of Assessment	4.1. Assessment may be conducted in the workplace or in a simulated work environment

UNIT TITLE : PERFORM MENSURATION AND CALCULATION
UNIT CODE : ELC311201
UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes and values needed identify, care, handle and use measuring instruments

ELEMENT	PERFORMANCE CRITERIA ***Italicized Bold*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Select measuring instruments	1.1 Object or component to be measured is identified 1.2 Correct specifications are obtained from relevant source 1.3 Measuring tools are selected in line with job requirements	• Category of measuring instruments • Types and uses of measuring instruments • Shapes and Dimensions • Formulas for volume, areas, perimeters of plane and geometric figures	• Identifying and selecting measuring instruments • Visualizing objects and shapes
2. Carry out measurements and calculation	1.1 Appropriate ***measuring instrument*** is selected to achieve required outcome 1.2 Accurate measurements are obtained for job 1.3 ***Calculation*** needed to complete work tasks are performed using the four basic process of addition (+), subtraction (-), multiplication (x), and division (/) 1.4 Calculation involving fractions, percentages and mixed numbers are used to complete workplace tasks. 1.5 Numerical computation is self-checked and corrected for accuracy 1.6 Instruments are read to the limit of accuracy of the tool.	• Calculation & measurement • Four fundamental operation • Linear measurement • Dimensions • Unit conversion • Ratio and proportion	• Performing calculation by addition, subtraction, multiplication and division; • Interpreting formulas for volume, areas, perimeters of plane and geometric figures • Handling of measuring instruments
3. Maintain measuring instruments	1.1 Measuring instruments are not dropped to avoid damage 1.2 Measuring instruments are cleaned before and after using. 1.3 Proper storage of instruments undertaken according to manufacturer's specifications and standard operating procedures.	• Types of measuring instruments and their uses • Safe handling procedures in using measuring instruments • Four fundamental operation of mathematics • Formula for volume, area, perimeter and other geometric figures	• Handling and maintaining measuring instruments

RANGE OF VARIABLES

VARIABLE	RANGE
1. Measuring instruments	1.1. Straight edge 1.2. Torque gauge 1.3. Try square 1.4. Protractor 1.5. Combination gauge 1.6. Steel rule
2. Calculation	Kinds of part mensuration includes the following but not limited to: 2.1. Volume 2.2. Area 2.3. Displacement 2.4. Inside diameter 2.5. Circumference 2.6. Length 2.7. Thickness 2.8. Outside diameter 2.9. Taper 2.10. Out of roundness

EVIDENCE GUIDE

1. Critical aspect of competency	Assessment requires evidence that the candidate: 1.1. Selected proper measuring instruments according to tasks 1.2. Carried out measurement and calculations 1.3. Maintained and stores instruments
2. Method of assessment	Competency in this unit must be assessed through: 2.1. Observation 2.2. Oral questioning
3. Resource implication	3.1. Place of assessment 3.2. Measuring instruments 3.3. Straight edge 3.4. Torque gauge 3.5. Try square 3.6. Protractor 3.7. Combination gauge 3.8. Steel rule
4. Context of Assessment	4.1. Assessment may be conducted in the workplace or in a simulated environment

UNIT TITLE : PREPARE AND INTERPRET TECHNICAL DRAWING

UNIT CODE : ELC311202

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes and values needed to prepare/interpret diagrams, engineering abbreviation and drawings, symbols, dimension.

ELEMENT	PERFORMANCE CRITERIA ***Italicized Bold*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Identify different kinds of technical drawings	1.1. Correct ***technical drawing*** is selected according to job requirements. 1.2. Technical drawings are segregated in accordance with the types and kinds of drawings	• Types of technical drawings • Applications for technical drawing • Methods of technical drawings • Symbols • Mark up/Notation of Drawings	• Reading skills required to interpret work instruction • Interpreting electrical/ electronic signs and symbols
2. Interpret technical drawing	2.1. Components, assemblies or objects are recognized as required. 2.2. ***Dimensions*** of the key features of the objects depicted in the drawing are correctly identified. 2.3. ***Symbols*** used in the drawing are identified and interpreted correctly. 2.4. Drawing is checked and validated against job requirements or equipment in accordance with standard operating procedures.	• Trade Mathematics o Linear measurement o Dimension o Unit conversion • Blueprint Reading and Plan Specification o Architectural, electrical, electronics, mechanical plan, symbols and abbreviations o Drawing standard symbols • Trade Theory o Basic technical drawing o Types technical plans o Various types of drawings o Notes and specifications	• Interpreting drawing/ orthographic drawing • Interpreting technical plans • Matching specification details with existing resources • Safety handling of drawing instruments
3. Prepare/ make changes to electrical/ electronic schematics and drawings	3.1. Electrical/electronic schematic is drawn and correctly identified. 3.2. Correct drawing is identified, equipment are selected and used in accordance with job requirements.	• Drawing conventions • Dimensioning Conventions • Mathematics o Four fundamental operations o Percentage o Fraction o Algebra o Geometry	• Reading skills required to interpret work instruction • Communication skills • Preparing/ Making electrical/ electronic signs and symbols • Computing formulas

ELEMENT	PERFORMANCE CRITERIA ***Italicized Bold*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS

4. Store technical drawings and equipment/ instruments	4.1. Care and maintenance of drawings are undertaken according to company procedures.
	4.2. Technical drawings are recorded and inventory is prepared in accordance with company procedures.
	4.3. Proper storage of instruments is undertaken according to company procedures.
		• Effective ways to catalogue and store technical drawings
		• Manual methods of handling, storing and maintaining paper drawings
		• Storing drawing in digital forms
		  ○ Scanner
		  ○ CAD
			• Handling and storing of drawings
			• Scanning and storing drawings in digital form
			• Matching specification details with existing resources
			• Handling of drawing instruments

RANGE OF VARIABLES

VARIABLE	RANGE
1. Technical drawings	Technical drawings include the following but not limited to: 1.1. Schematic diagrams 1.2. Charts 1.3. Block diagrams 1.4. Lay-out plans 1.5. Location plans 1.6. Process and instrumentation diagrams 1.7. Loop diagrams 1.8. System Control Diagrams
2. Dimensions	Dimensions may include but not limited to: 2.1. Length 2.2. Width 2.3. Height 2.4. Diameter 2.5. Angles
3. Symbols	May include but not limited to: 3.1. NEC- National Electric Code 3.2. IEC -International Electrotechnical Commission 3.3. ASME - American Society of Mechanical Engineers 3.4. IEEE - Institute of Electrical and Electronics Engineers 3.5. ISA - Instrumentation System and Automation Society
4. Instruments/Equipment	4.1. Components/dividers 4.2. Drawing boards 4.3. Rulers 4.4. T-square 4.5. Calculator

EVIDENCE GUIDE

1. Critical aspect of competencies	Assessment requires evidence that the candidate: 1.1. selected correct technical drawing in line with job requirements 1.2. correctly identified the objects represented in the drawing 1.3. identified and interpreted symbols used in the drawing correctly 1.4. prepared/produced electrical/electronic drawings including all relevant specifications 1.5. stored diagrams/equipment
2. Method of assessment	Competency in this unit must be assessed through: 2.1. Practical tasks involving interpretation of a range of technical drawings 2.2. Oral questioning
3. Resource implication	3.1. Drawings 3.2. Diagrams 3.3. Charts 3.4. Plans
4. Context of Assessment	4.1 Assessment may be conducted in the workplace or in a simulated environment

UNIT TITLE : **APPLY QUALITY STANDARDS**

UNIT CODE : **ELC311204**

UNIT DESCRIPTOR : This unit covers the knowledge, skills, (and) attitudes and values needed to apply quality standards in the workplace. The unit also includes the application of relevant safety procedures and regulations, organization procedures and customer requirements

ELEMENT	PERFORMANCE CRITERIA ***Italicized Bold*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Assess quality of received materials or components	1.1. Work instructions are obtained and work is carried out in accordance with standard operating procedures 1.2. Received ***materials or component parts*** are checked against workplace standards and specifications 1.3. Faulty material or components related to work are identified and isolated 1.4. ***Faults*** and any identified causes are recorded and/or reported to the supervisor concerned in accordance with workplace procedures 1.5. Faulty materials or components are replaced in accordance with workplace procedures	• Relevant production processes, materials and products • Characteristics of materials, software and hardware used in production processes • Quality checking procedures • Quality Workplace procedures • Identification of faulty materials related to work	• Reading skills required to interpret work instruction • Critical thinking • Interpreting work instructions
2. Assess own work	2.1. ***Documentation*** relative to quality within the company is identified and used 2.2. Completed work is checked against workplace standards relevant to the task undertaken 2.3. Faulty pieces are identified and isolated 2.4. Information on the quality and other indicators of production performance is recorded in accordance with workplace procedures 2.5. In cases of deviations from specified ***quality standards***, causes are documented and reported in accordance with the workplace' standards operating procedures	• Safety and environmental aspects of production processes • Fault identification and reporting • Workplace procedure in documenting completed work • Workplace Quality Indicators	• Carry out work in accordance with OHS policies and procedures

ELEMENT	PERFORMANCE CRITERIA ***Italicized Bold*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
3. Engage in quality improvement	3.1. Process improvement procedures are participated in relation to workplace assignment 3.2. Work is carried out in accordance with process improvement procedures 3.3. Performance of operation or quality of product or service to ensure ***customer*** satisfaction is monitored	• Quality improvement processes • Company customers defined	• Solution providing and decision-making • Practice company process improvement procedure

RANGE OF VARIABLES

VARIABLE	RANGE
1. Materials/components	1.1. Materials may include but not limited to: 1.1.1. wires 1.1.2. cables, soldering lead 1.1.3. electrical tape 1.2. Components may include but not limited to: 1.2.1. ICs 1.2.2. Diodes
2. Faults	Faults may include but not limited to: 2.1. Components/materials not according to specification 2.2. Components/materials contain manufacturing defects 2.3. Components/materials do not conform with government regulation i.e., PEC, environmental code 2.4. Components/materials have safety defect
3. Documentation	3.1. Organization work procedures 3.2. Manufacturer's instruction manual 3.3. Customer requirements 3.4. Forms
4. Quality standards	4.1. Quality standards may relate but not limited to the following: 4.1.1. materials 4.1.2. component parts 4.1.3. final product 4.1.4. production processes
5. Customer	5.1. Co-worker 5.2. Supplier 5.3. Client 5.4. Organization receiving the product or service

EVIDENCE GUIDE

1. Critical aspect of competency	Assessment must show that the candidate: 1.1. Carried out work in accordance with the company's standard operating procedures 1.2. Performed task according to specifications 1.3. Reported defects detected in accordance with standard operating procedures 1.4. Carried out work in accordance with the process improvement procedures
2. Method of assessment	2.1. The assessor may select two (2) of the following assessment methods to objectively assess the candidate: 2.1.1. Observation 2.1.2. Questioning 2.1.3. Practical demonstration
3. Resource implication	3.1. Materials and component parts and equipment to be used in a real or simulated electronic production situation
4. Context of Assessment	4.1. Assessment may be conducted in the workplace or in a simulated environment.

UNIT TITLE : **TERMINATE AND CONNECT ELECTRICAL WIRING AND ELECTRONICS CIRCUIT**

UNIT CODE : **ELC311206**

UNIT DESCRIPTOR : This unit covers the knowledge, skills, (and) attitudes and values needed to terminate and connect electrical wiring and electronic circuits

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Plan and prepare for termination/ connection of electrical wiring/electronics circuits	1.1. ***Materials*** are checked according to specifications and tasks 1.2. Appropriate ***tools and equipment*** are selected according to tasks requirements 1.3. Task is planned to ensure OH & S guidelines and procedures are followed 1.4. Electrical wiring/electronic circuits are correctly prepared for connecting/termination in accordance with instructions and work site procedures	• Use of tools • Use of test instruments/ equipment • Electrical theory • Principals of AC and DC • OH & S guidelines and procedures • Basic electrical and electronic devices	• Reading skills required to interpret work instruction • Checking materials for conformance to specifications • Checking existing and new installation site for correct location and specification
2. Terminate/ connect electrical wiring/ electronic circuits	2.1. Safety procedures in using tools are observed at all times and appropriate ***personal protective equipment*** are used 2.2. Work is undertaken safely in accordance with the workplace and standard procedures 2.3. Appropriate range of ***methods*** in termination/ connection are used according to specifications, manufacturer's requirements and safety 2.4. Correct sequence of operation is followed 2.5. ***Accessories*** used are adjusted, if necessary 2.6. Confirmed termination/connection is undertaken successfully in accordance with job specification	• Wiring techniques • OH & S principles • Use of lead-free soldering technology • Surface mount soldering techniques • Specifications and methods for terminating different materials	• Communication skills • Marking, tagging and labeling requirements for cables, wires, conductors and connections • Soldering techniques • Adjusting and fixing wiring supports

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
3. Test termination/ connections of electrical wiring/ electronics circuits	3.1. Testing of all completed termination/ connections of electric wiring/electronic circuits is conducted for compliance with specifications and regulations using appropriate procedures and equipment 3.2. Wiring and circuits are checked using specified testing procedures 3.3. Unplanned events or conditions are responded to in accordance with established procedures	• AC and DC power supplies • Uses of diagnostic equipment • Tests for wiring and connections • Wiring support techniques and alternatives	• Printed circuit board repair and techniques • Electronic assembly functional and quality testing • Testing of wiring and connections for conformance to specification

RANGE OF VARIABLES

VARIABLE	RANGE
1. Materials	1.1 Materials included the following but not limited to: 1.1.1 Soldering lead 1.1.2 Cables 1.1.3 Wires
2. Tools and equipment	2.1 Tools for measuring, cutting, drilling, assembling/disassembling. Tool set includes the following but not limited to: 2.1.1 Pliers 2.1.2 Cutters 2.1.3 Screw drivers 2.2 Equipment 2.2.1 Soldering gun 2.2.2 Multi-tester
3. Personal protective equipment	3.1 goggles 3.2 gloves 3.3 apron/overall
4. Methods	4.1 Clamping 4.2 Pin connection 4.3 Soldered joints 4.4 Plugs
5. Accessories	5.1 Accessories may include the following but not limited to: 5.1.1 brackets 5.1.2 clamps

EVIDENCE GUIDE

1. Critical aspect of competency	Assessment requires evidence that the candidate: 1.1. Undertook work safely and according to workplace and standard procedures 1.2. used appropriate termination/ connection methods 1.3. followed correct sequence in termination / connection process 1.4. conducted testing of terminated connected electrical wiring/electronic circuits using appropriate procedures and standards
2. Method of assessment	2.1. The assessor may select two (2) of the following assessment methods to objectively assess the candidate: 2.1.1. Observation 2.1.2. Oral Questioning 2.1.3. Practical demonstration
3. Resource implication	3.1. Tools for measuring, cutting, drilling, assembling/disassembling, connecting. Tool set includes the following but not limited to: 3.1.1. screw drivers 3.1.2. pliers 3.1.3. cutters
4. Context of Assessment	4.1. Assessment may be conducted in the workplace or in a simulated work environment

UNIT OF COMPETENCY: MAINTAIN TOOLS AND EQUIPMENT
UNIT CODE : ELC311212

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes on checking condition, performing preventive maintenance and storing of tools and equipment based on the required performance standards.

ELEMENTS	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Check condition of tools and equipment	1.1 ***Materials, tools and equipmen***t are identified according to classification and job requirements 1.2 Non-functional tools and equipment are segregated and labeled according to classification 1.3 Safety of tools and equipment are observed in accordance with manufacturer's instructions 1.4 Condition of ***PPE*** are checked in accordance with manufacturer's instructions	• Safety Practices ○ Use of PPE ○ Handling of tools and equipment ○ Good housekeeping • Materials, Tools and Equipment ○ Types and uses of lubricants ○ Types and uses of cleaning materials ○ Types and uses of plumbing tools ○ Types and uses of plumbing equipment • Operational conditions of electrical tools and equipment • Electrical tools and equipment defects	• Maintaining tools and equipment • Handling of tools and equipment • Identifying tools and equipment defects
2. Perform basic preventive maintenance	2.1 Appropriate lubricants are identified according to types of equipment 2.2 Tools and equipment are lubricated according to preventive maintenance schedule or manufacturer's specifications 2.3 Measuring instruments are checked and calibrated in accordance with manufacturer's instructions 2.4 Tools are cleaned and lubricated according to standard procedures 2.5 Defective instruments, equipment and accessories are inspected and replaced according to manufacturer's specifications	• Safety Practices ○ Use of PPE ○ Handling of tools and equipment ○ Good housekeeping • Materials, Tools and Equipment ○ Types and uses of lubricants ○ Types and uses of cleaning materials • Preventive Maintenance ○ Methods and techniques ○ Procedures	• Handling of tools and equipment • Performing preventive maintenance

ELEMENTS	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	2.6 Tools are inspected, repaired and replaced after use 2.7 Work place is cleaned and kept in safe state in line with OHSA regulations		
3. Store tools and equipment	3.1 Inventory of tools, instruments and equipment are conducted and recorded as per company practices 3.2 Tools and equipment are stored safely in appropriate locations in accordance with manufacturer's specifications or company procedures	• Safety Practices ○ Use of PPE ○ Handling of tools and equipment ○ Storing procedures and techniques ○ Storage conditions/ locations	• Storing tools and equipment • Handling of tools and equipment

RANGE OF VARIABLES

VARIABLES	RANGE
1. Materials	Including but not limited to: 1.1 Lubricants 1.2 Cleaning materials 1.3 Rust remover 1.4 Rugs 1.5 Spare parts
2. Tools and equipment	Including but not limited to: 2.1 Tools - Cutting tools - hacksaw, crosscut saw, rip saw - Boring tools - auger, brace, grinlet, hand drill - Holding tools - vise grip, C-clamp, bench vise - Threading tools - die and stock, taps 2.2 Measuring instruments/equipment
3. PPE	Including but not limited to: 3.1 Goggles 3.2 Gloves 3.3 Safety shoes 3.4 Aprons/Coveralls
4. Forms	4.1 Maintenance schedule forms 4.2 Requisition slip 4.3 Inventory Form 4.4 Inspection Form 4.5 Procedures

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires that the candidate: 1.1 Selected and used appropriate processes, tools and equipment to carry out task 1.2 Identified functional and non-functional tools and equipment 1.3 Checked, lubricated and calibrated tools, equipment and instruments according to manufacturer's specifications 1.4 Replaced defective tools, equipment and their accessories 1.5 Observed and applied safe handling of tools and equipment and safety work practices 1.6 Prepared and submitted inventory report, where applicable 1.7 Maintained workplace in accordance with OHSA regulations 1.8 Stored tools and equipment safely in appropriate locations and in accordance with company practices
2. Resource implications	The following resources should be provided: 2.1 Workplace 2.2 Maintenance schedule 2.3 Maintenance materials, tools and equipment relevant to the proposed activity/task
3. Methods of assessment	Competency should be assessed through: 3.1 Direct observation 3.2 Written test/questioning relevant to Underpinning knowledge
4. Context of assessment	4.1 Competency assessment may occur in workplace or any appropriate simulated environment 4.2 Competency assessment must be undertaken in accordance with the endorsed TESDA assessment guidelines

CORE COMPETENCIES

UNIT OF COMPETENCY : **PERFORM ROUGHING-IN AND WIRING ACTIVITIES FOR THREE-PHASE DISTRIBUTION SYSTEM FOR POWER, LIGHTING AND MOTOR CONTROL PANEL**

UNIT CODE : **ELC741304**

UNIT DESCRIPTOR : This unit of Core Electrical Competencies covers the knowledge and attitudes on installing cable tray, power panel, lighting panel and motor control center (MCC), fittings, under the required performance standard. This also includes wiring and completion works.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variable	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Prepare for rough-in and wiring works	1.1 Technical drawings and plans are interpreted determine job requirements 1.2 Correct type and quantity of cable trays, power and lighting panels and MCC are identified and selected in line with job requirements 1.3 ***Tools and equipment*** are selected in line with job requirements 1.4 Correct ***PPE*** are identified and selected in line with safety requirements	• Types of wiring diagram based on ANSI or IEC Standard. • Types of enclosure, proofing and mounting configuration • Types and uses of tools, materials and equipment for roughing-in and wiring. • Proper used of safety harness.	• Interpreting plan and details drawing. • Identifying the required • proofing of the panel and enclosure. • Identifying the functional and defective tools, materials and equipment.
2. Install cable tray and panel	2.1 ***Safety procedures*** are followed 2.2 ***Correct procedures for installation*** of cable tray and panel is performed in line with job requirements 2.3 Schedule of work is monitored to ensure work is completed in an agreed time, to a quality standard and with a minimum of waste 2.4 Unplanned events or conditions occurred are responded to accordingly 2.5 Checks of quality of work are undertaken in accordance with instructions and requirements	• Interpretation of electrical/ mechanical drawings • Cable trays o Uses and specifications • Panel board o Uses and specifications o Circuit breaker o Types of mounting of protective device o Circuit home run requirements • Proper procedure in installation of cable tray, fittings and panels. • Installation techniques for maintenance accessibility	• Blue Print reading skills required to interpret work instructions. • Performing installation • economically and based on job specifications

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variable	REQUIRED KNOWLEDGE	REQUIRED SKILLS
		• Proper use of safety harness. • PEC requirements in cable tray and panel installation	
3. Perform wiring works	3.1 Safety procedures are followed based on safety regulations PPE are identified and selected in line with safety requirements 3.2 Tools, equipment, pulling compound and safety requirements are identified and obtained for the lay out and installation. 3.3 Pulling materials are properly installed and tensioned to required specifications 3.4 Cable is secured permanently to support structure in accordance with standard ***installation procedures*** 3.5 Bending radius and loops tolerance is observed for cable materials at all times 3.6 Schedule of wire cutting lists is followed based on estimates, quantity and sizes to avoid wastage. 3.7 Further instructions are sought if unplanned events or conditions occur 3.8 Checking of quality of work is done in accordance with instructions and requirements.	• Wiring works provisions in DOLE Department Order No. 13 s. 1998- Guidelines Governing Occupational Safety and Health in the Construction Industry • Wiring procedures such as cable lay-out, pulling splicing and wire termination. • Usage of different type of wires and cables and its applications • Markings of circuit homeruns • Application of pulling compound. • Bundling of wire size as per job requirement. • PEC requirements in wiring works	• Interpreting plans and drawings • Handling of materials, tools and equipment • Applying methods and • techniques in various type of wiring wires and cables • Splicing and terminating wires
4. Complete work activity	4.1 Final checks are made to ensure that work conforms with instructions and to requirements 4.2 Tools, equipment and any surplus resources and materials are checked/ monitored in accordance with established procedures 4.3 Work area is checked as to cleanliness and safety. 4.4 Waste materials and hazardous substances are disposal of in accordance with environmental rules and procedures.	• Processes, Operations, Systems o Maintenance of tools o Storage of tools • Procedures in checking and conforming the installation based on job requirement • Proper disposal of waste materials and hazardous substances • Principles of good housekeeping	• Performing commisioning activities • Performing good housekeeping

RANGE OF VARIABLES

VARIABLE	RANGE
1. Tools and equipment	Including but not limited to: 2.1 Pliers 2.7. Rivet 2.2 Screwdrivers 2.8 Mallet 2.3 Wrenches 2.4 Wire splicers 2.5 Knives 2.6 Face shield
2. Personal protective equipment (PPE)	Including but not limited to: 3.1 Working gloves 3.2 Safety shoes 3.3 Hard hat
3. Safety procedures	Includes safety procedures in: 4.1 Philippine Electrical Code 4.2 Industrial safety standards 4.3 Electrical safety standards
4. Correct procedures for Installation of bus ducts and cable tray	5.1 Bus ducts - Joints between sections and fittings are accessible for maintenance purposes - Bus ducts shall be securely supported - Vertically and horizontally aligned - Dead end of busway shall be closed 5.2 Cable tray - Properly supported, aligned and spaced - Measurements referred to center of insert holes
5. Installation procedures	5.1 Horizontally and vertically aligned 5.2 No gap between plate cover and wall 5.3 Wire cut to requirement 5.4 All bolts tightened for rigid mounting

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment required evidence that the candidate: 1.1 Interpreted technical drawings and plans to determine job requirements 1.2 Selected appropriate tools, equipment and materials for performing rough-in and wiring activities 1.3 Selected and used correct personnel protective equipment 1.4 Demonstrated correct procedures for performing rough-in activities such as installing bus ducts, cable tray and panel 1.5 Followed safety procedures 1.6 Performed wiring works 1.7 Made final checks to ensure work completion and conforms with the working plan
2. Resource Implications	The following resources should be provided: 2.1 Workplace location 2.2 Tools and equipment appropriate to building wiring electrical installation 2.3 Materials relevant to the proposed activity 2.4 Drawings and specifications relevant to the task
3. Methods of Assessment	Competency in this unit must be assessed: 3.1 Direct observation/Demonstration of application of tasks. 3.2 Questions related to underpinning knowledge 3.3 Written Test
4. Context for Assessment	4.1 Competency may be assessed in the workplace or in a simulated workplace setting 4.2 Assessment shall be observed while the tasks are being undertaken either individually or as part of a team under limited supervision

UNIT OF COMPETENCY: **PERFORM INSTALLATION OF DATA MEASUREMENT AND CONTROL SYSTEM ON ELECTRICAL AND AUXILLIARY EQUIPMENT**

UNIT CODE : **ELC741305**

UNIT DESCRIPTOR : This unit of Core Electrical Competency covers the knowledge, skills and attitudes in installing wiring devices for power supply of data measurement and control system on electrical and auxiliary equipment such as UPS, drytype, transformer, capacitor bank AVR and rectifier based on required performance standard.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variable	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Plan and prepare for installation work	1.1 Instructions for the preparation of work activity are communicated and confirmed to ensure clear understanding 1.2 ***Tools, equipment*** and ***personnel protective equipment*** needed to ***electrical system and auxiliary equipment*** are identified and checked to ensure usability and safety in accordance with established procedures 1.3 Materials needed to do the work are obtained and estimated in accordance with established procedures and plan	• Types and specification of wiring devices for data measurement and control system. • Functions and uses of power supply on data measurement system and auxiliary equipment. • Identification of tools and materials for installation of data measurement and control system on electrical and auxiliary equipment	• Interpreting plans and details drawing. • Handling of materials, tools and equipment • Checking and quantifying the item needed, in the job requirement.
2. Install electrical system and auxiliary equipment	2.1 ***Safety procedures*** are followed in line with job requirements 2.2 Correct procedures for ***installation of electrical system and auxiliary equipment*** are performed in line with job requirements 2.3 Schedule of work is followed to ensure work is completed in an agreed time, to a quality standard and with a minimum of waste 2.4 Unplanned events or conditions occurred are responded to accordingly 2.5 On going checks of quality of work are undertaken in accordance with instructions and requirements 2.6 Conductors/wires are terminated/spliced in accordance with electrical standards	• Procedures on installation of electrical system and auxiliary equipment. • Proper used of power tools and equipment in an installation. • Splicing, dressing and harnessing of wires. • Proper termination and mounting of devices. • Proper use of safety harness • Types and uses of: ○ UPS ○ Drytype Transformer ○ Capacitor bank ○ AVR	• Installing AVR and UPS • Performing splicing, dressing and harnessing of wires. • Mounting of devices. • Performing the installation economically. • Applying active and non-active test to ensure its functionality.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variable	REQUIRED KNOWLEDGE	REQUIRED SKILLS
		○ Rectifier ○ other metering/ central aux. equipment • PEC requirements in installation of electrical system and auxiliary equipment	
3. Notify completion of work	3.1 Final checks are made to ensure that work conforms with instructions and to requirements 3.2 Completion report is prepared and submitted to appropriate officer 3.3 Tools, equipment and any surplus resources and materials are checked and monitored in accordance with established procedures 3.4 Work area is monitored as to cleanliness and safety	• Procedures in checking and conforming the installation based on job requirement • Procedures in report preparation and submission • Principles of good housekeeping	• Performing commisioning activities • Performing good housekeeping

RANGE OF VARIABLES

VARIABLE	RANGE
1. Tools and equipment	1.1 Electrical power tools 1.2 Hand tools 1.3 Multi-testers, mega-ohmmeter, clamp-on meter
2. Personal protective equipment (PPE)	Includes but is not limited to: 2.1 Working gloves 2.2 Safety shoes 2.3 Hard hat 2.4 Goggles/face shield
3. Electrical system and auxiliary equipment	3.1 UPS 3.2 Drytype 3.3 Transformer 3.4 Capacitor bank 3.5 AVR 3.6 Rectifier/Frequency converter 3.7 Fire alarm system 3.8 Intercom 3.9 Digital watt meter
4. Safety procedures	4.1 Philippine Electrical Code (PEC) 4.2 Industrial safety 4.3 Electrical safety
5. Installation of electrical system and auxiliary equipment	5.1 Installed and connected as per plan 5.2 Magnetic switches installed 5.3 Conducted preliminary testing prior to commissioning

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1 Correctly followed work instructions 1.2 Identified and checked appropriate tools, equipment and materials for installing electrical system and auxiliary equipment 1.3 Selected and used correct personal protective equipment 1.4 Performed correct procedures for installation of electrical system and auxiliary equipment 1.5 Terminated/Spliced conductors/wires in accordance with the existing electrical standards 1.6 Made final checks to ensure work conforms with the plan 1.7 Followed safety procedures
2. Resource Implications	The following resources should be provided: 2.1 Workplace location 2.2 Tools and equipment appropriate to installation of electrical and auxiliary equipment 2.3 Materials relevant to the activity 2.4 Wiring diagrams, layout/shop drawings and specifications relevant to the task
3. Methods of Assessment	Competency in this unit must be assessed: 3.1 Direct observation/Demonstration of application of tasks. 3.2 Questions related to underpinning knowledge 3.3 Written Test
4. Context for Assessment	4.1 Competency may be assessed in the workplace or in a simulated workplace setting 4.2 Assessment shall be observed while the tasks are being undertaken either individually or as part of a team under limited supervision

UNIT OF COMPETENCY : **INSTALL, ASSEMBLE, TEST AND MAINTAIN MOTOR CONTROL SYSTEM**

UNIT CODE : **ELC741306**

UNIT DESCRIPTOR : This unit of Core Electrical Competency covers the knowledge, skills and attitudes in installing, assembling, testing and maintaining motor control system.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variable	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Check/ Review type and purpose of motor control system.	1.1. ***Wiring diagrams*** and layout/ shop drawings are obtained according to job requirements 1.2. Drawings are read and interpreted in accordance with job requirements 1.3. Correct rating, quantity, sizes and type of ***motor control components & wiring devices*** and other materials are identified in line with job requirements 1.4. Correct size and ***degree of protection*** of enclosures are verified in line with job requirements 1.5. ***Tools, equipment and testing instruments*** are properly selected in line with job requirements 1.6. Correct ***PPE*** are identified and selected in line with safety requirements	• Interpretation of electrical drawing and wiring diagram. • Function of every devices used in the line/ job requirements • Motor specification for the selection of control devices. • NEMA Standard in mounting of MCC. • Electrical control components and devices • Safe working habits/Safety procedures	• Interpreting electrical drawing and wiring diagram • Checking and quantifying items needed in the job requirement • Checking the required rating based on its specification in accordance with standard.
2. Install and assemble motor control system	2.1 Safety procedures are followed according to enterprise or based on ***PEC standard and requirements***. 2.2 Electrical components and wiring devices are laid-out, mounted or installed according to drawings, plans, ***specifications*** and PEC standards 2.3 Electrical motor control components are wired correctly in accordance with wiring diagrams and PEC standards 2.4 ***Preliminary checks/ tests*** are conducted in line/ job requirements. 2.5 Work schedule is followed to ensure job is completed on time in accordance to a quality standard and minimum wastage.	• Lay-out and dimensions of electrical drawing or wiring diagram. • Types and operation of motor control system. • Types and uses of termination either point to point termination or terminal strip. • Correct procedures in assembling motor control system • Proper procedure mounting and installation of panels/MCC. • Proper terminal connection of motor leads outs.	• Interpreting the electrical wiring diagram of motor control system. • Wiring-up the required electrical control based on the standard. • Connecting and Terminating of motor terminal/ leads out and the control devices. • Checking for continuity test or ohmmeter test of motor terminal

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variable	REQUIRED KNOWLEDGE	REQUIRED SKILLS
		• PEC standards - Article 4.30	• Performing the installation economically.
3. Notify completion of work	3.1 Immediate superior is notified upon completion of work. 3.2 ***Performance tests*** are made to ensure that work conforms to instructions and job requirements. 3.3 Tools, equipment and any surplus materials are cleaned, checked and returned to storage in accordance with established procedures. 3.4 Waste materials and hazardous substances are disposed of in accordance with environmental rules and regulations. 3.5 Work area is cleaned up and made safe in accordance with OSHA requirements	• Checked and conformed the installation based on job requirement • Principles of 5S • Proper disposal of waste materials and hazardous substances • Good housekeeping	• Performing commissioning activities • Storing excess materials • Checking quality of work • Communicating skills (both written & oral)
4. Maintain electrical motor control system.	4.1 Safety policies and procedures are followed in accordance with OSH and enterprise procedures. 4.2 ***Materials, tools, equipment***, ***testing devices*** and ***PPE*** needed are prepared for the maintenance work requirements. 4.3 ***Potential hazards*** are identified for prevention and control measures are selected in accordance with the work plan and site procedures 4.4 Routine/visual/sensory inspection is regularly conducted in line with normal operation. 4.5 Maintenance work schedule is prepared in accordance with machine/equipment operating time/condition 4.6 Work instructions are prepared according to machine's manual and established enterprise procedures 4.7 Concerned department/ personnel are informed on the schedule of work according to standard operating procedure. 4.8 Availability of ***maintenance records*** are prepared in accordance with established procedure, or based on enterprise ***Quality Management System (QMS).***	• Safety Practices in the use of PPE, handling of tools, instrument and equipment. • Types and uses of lubricants and cleaning materials • Preventive Maintenance Methods and Techniques and Procedures. • Types of potential hazards • Maintenance and troubleshooting procedures • Good housekeeping of materials, tools and equipment	• Selecting prevention and/or control measures • Handling of tools, instrument and equipment. • Performing basic troubleshooting skills • Identifying failures or defects • Implementing corrective and preventive actions based on root cause of trouble • Application of maintenance procedures

RANGE OF VARIABLES

VARIABLE	RANGE
1. Wiring diagrams	1.1 Power circuit 1.2 Control circuit
2. Motor control components & wiring devices	May include but are not limited to: 2.1 Circuit breakers/Fuses 2.2 Magnetic Contactors 2.3 Overload heater 2.4 Power Cabinet or MCC 2.5 Power and Timers Relays 2.6 Terminal Blocks/Lugs 2.7 Pilot lamps and Buzzer 2.8 Actuators 2.9 Push buttons 2.10 Selector Switches 2.11 Cable duct 2.12 Din rail 2.13 Wire Strap 2.14 Wire Markers 2.15 Cable Tie 2.16 Tie Mount 2.17 Cable Glands/Grommet 2.18 Automotive wires/Conductors 2.19 Insulators
3. Degree of Protection	3.1 Nema Standards - Nema 1 - Nema 2 - Nema 3/3R - Nema 4/4x - Nema 6 - Nema 11 - Nema 12 3.2 IEC Standards - International Protection (IP) 3.3 Bureau of Product Standards (BPS)
4. Tools, equipment & testing instruments	May include but are not limited to: 4.1 Tools - Pliers - Screw drivers - Wrenches - Wire splicers/strippers - Electrician knives - Electric Hand drill - Hand or electric taping/threading - Hack saw - File - Manual/Hydraulic puncher - Measuring tools (e.g. Push-pull meter)

VARIABLE	RANGE
	- Crimping tools - Soldering tools - Manual/Hydraulic pipe bender - Manual/Electrical Pipe Threader/Reamer - High-speed cutter 4.2 Testing Instruments - Multi-tester - Clamp ammeter - Insulation resistance tester - Ground resistance tester - Earth leakage tester - Harmonic meter - Phase Sequence Tester 4.3 Three-Phase Motor - SCRIM - WRIM - Synchronous Motor 4.4 Single Phase Motor
5. Personal protective equipment (PPE)	May include but are not limited to: 5.1 Proper working clothes 5.2 Working gloves 5.3 Safety shoes 5.4 Gas/Dust mask 5.5 Hard hat 5.6 Safety goggles
6. Specifications	6.1 Brand/Make - Classification/Type 6.2 Rating - Voltage - Current - Power - Frequency - Temperature Rise - Service factor - Degree of protection - Utilization category - Harmonics 6.3 Phase 6.4 Range (Tools must be specific) 6.5 Needed accessories
7. PEC standard and requirements	7.1 Splicing and joining of electrical conductor 7.2 Soldering electrical conductors 7.3 Solderless electrical connectors 7.4 Creepage distances 7.5 Clearances

VARIABLE	RANGE
8. Preliminary Check/Tests	May include but are not limited to: 8.1 Mechanical - Board/Panel properly leveled - Doors can be opened/closed with ease. Paint not easily scratched/removed - Tightness of bolts and nuts - Type of protection - Cleanliness - Cable trays 8.2 Electrical - Conductor size or Cross-section - Conductor Color Coding - Cables laid to avoid risk of short circuit - Grounding busbar conductor - Voltage Clearances/Creepage Distances - Control Voltage - High Voltage Test - Insulation Test - Continuity Test/Contact Resistance Test - Correct use of wire markers & terminals
9. Performance Tests	9.1 Simulation Test/No Load Test 9.2 Phase sequence 9.3 Actual Operation 9.4 Temperature rise 9.5 Insulation Resistance Test
10. Materials	May include but not limited to: 10.1 Contact cleaner 10.2 Insulating varnish/materials 10.3 Carbon brushes 10.4 Sand paper 10.5 Waste rugs 10.6 Electrical tapes 10.7 Warning tags 10.8 Signages 10.9 Lockout/tagout 10.10 Lubricants 10.11 Motor cleaner 10.12 Insulating oil 10.13 Coolant

VARIABLE	RANGE
11. Tools, equipment and testing devices	Including but not limited to: 11.1 Electrician's hand tools - Pliers - Screwdrivers - Wrenches - Wire splicers - Knives - Bolt/Cable cutter - Knockout puncher - Torque wrench 11.2 Testing instruments/devices - Multi-tester (VOM) - Insulation resistance tester (Megger) - High potential tester - Low resistance tester - Phase sequence meter - Ammeter - Torque meter 11.3 Equipment - Labeling machine - Vacuum cleaner - Air blower - Dryer - Welding machine - Pressure washer - Vacuum pump
12. Personal protective equipment (PPE)	Including but not limited to: 12.1 Working gloves 12.2 Safety shoes 12.3 Hard hat 12.4 Face shield 12.5 Insulating mat 12.6 Lockout tags 12.7 Safety goggles 12.8 Safety belt 12.1 Safety ladder
13. Potential hazards	Including but not limited to: 13.1 Live wires 13.2 Oil spill 13.3 Chemical hazards 13.4 Flammable materials 13.5 Sources of energy 13.6 Moving machine parts 13.7 Sharp/pointed objects 13.8 Noise hazards 13.9 Confined space

VARIABLE	RANGE
14. Maintenance records	May include but are not limited to: 14.1 Electrical plans 14.2 Equipment electrical diagrams 14.3 Historical records - Job orders - Commissioning test record - Preventive Maintenance schedules - Corrective Maintenance records - Manufacturer's maintenance guides - Equipment breakdown records - Periodic monitoring data - Service reports 14.4 Log book
15. Quality Management System	15.1 ISO 9001 15.2 QS 9000 15.3 TS 16949 15.4 ISO 14000 15.5 ISO14001

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1 Checked/Reviewed type and purpose of motor control system 1.2 Installed and assembled motor control system. 1.3 Notified completion of work 1.4 Maintained electrical motor control system
2. Resource Implications	The following resources should be provided: 2.1 Workplace location 2.2 Tools and equipment appropriate to assembly of electrical control system 2.3 Materials relevant to the activity 2.4 Wiring diagrams, layout/shop drawings and specifications relevant to the task
3. Methods of Assessment	Competency in this unit must be assessed through: 3.1 Direct observation/demonstration of application of tasks 3.2 Questions or interview related to underpinning knowledge 3.3 Written Test (about symbols)
4. Context for Assessment	4.1 Competency may be assessed in the workplace – to observe/check workmanship, correct function of work, length of time in doing the work 4.2 Assessment shall be observed while the tasks are being undertaken either individually or as part of a team under limited supervision

SECTION 3 TRAINING ARRANGEMENTS

These standard arrangement are developed to give technical and vocational education and training (TVET) provides information and guidance on important requirements needed when designing training programs for Electrical Installation and Maintenance NC III.

This includes information on curriculum design; training delivery; trainee entry requirements; tools and equipment; training facilities; and trainer's qualification and institutional assessment.

3.1 CURRICULUM DESIGN

TESDA shall provide the training on the development of competency-based curricula to enable training providers develop their own curricula with the components mentioned below.

Delivery of knowledge requirements for the basic, common and core units of competency specifically in the areas of mathematics, science/technology, communication/language and other academic subjects shall be contextualized. To this end, TVET providers shall develop a Contextual Learning Matrix (CLM) to accompany their curricula.

Course Title: Electrical Installation and Maintenance NC Level: **NC III**

Nominal Training Hours:

Basic Competencies	-	32 Hours
Common Competencies	-	32 Hours
Core Competencies	-	96 Hours
Total Course Hours		**160 Hours**

Course Description:

This course is designed to develop & enhance the knowledge, skills, & attitudes of an electrical, mechatronics and automation technician, in accordance with industry standards. It covers the basic & common competencies in addition to the core competencies as enumerated in section 1 of this training regulations.

To obtain this, all units prescribed for this qualification must be achieved:

BASIC COMPETENCIES

32 hours

This course is designed to equip individual with operational skills required for Basic Worker Competencies of Electrical Installation & Maintenance III with learning outcomes, methodology and assessment approach as listed herein.

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration
1. Lead workplace communication	1.1 Communicate information about workplace processes	• Read o Effective verbal communication methods o Sources of information	• Lecture	• Written Test	2 Hours
		• Practice organizing information	• Demonstration	• Observation	
		• Identify organization requirements for written and electronic communication methods	• Lecture	• Written Test	
		• Follow organization requirements for the use of written and electronic communication methods	• Demonstration • Practical exercises	• Observation	
		• Perform exercises on understanding and conveying intended meaning scenario	• Demonstration • Role Play	• Observation	
	1.2 Lead workplace discussions	• Describe: o Organizational policy on production, quality and safety o Goals/ objectives and action plan setting	• Group discussion	• Oral evaluation	2 Hours
		• Read o Effective verbal communication methods	• Lecture	• Written Test	
		• Prepare/set action plans based on organizational goals and objectives	• Demonstration	• Observation	

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration
	1.3 Identify and communicate issues arising in the workplace	• Describe: o Organizational policy in dealing with issues and problems	• Group discussion	• Oral evaluation	2 Hours
		• Read o Effective verbal communication methods	• Lecture	• Written Test	
		• Practice organizing information	• Demonstration	• Observation	
		• Perform exercises on understanding and conveying intended meaning scenario	• Demonstration • Role Play	• Observation	
2. Lead small team	2.1 Provide team leadership	• Describe: o Company policies and procedures	• Group discussion	• Oral evaluation	2 Hours
		• Identify client expectations	• Lecture	• Written examination	
		• Practice team building skills	• Demonstration	• Observation	
		• Perform exercises on communication skills required for leading teams	• Demonstration • Role Play	• Observation	
	2.2 Assign responsibilities	• Describe: o Team member's duties and responsibilities	• Group discussion	• Oral evaluation	2 Hours
		• Identify client expectations	• Lecture	• Written examination	
		• Practice negotiating skills	• Demonstration	• Observation	
		• Perform group exercises showing the skills and techniques in promoting team building	• Demonstration • Role Play	• Observation	
	2.3 Set performance expectations for team members	• Describe: o Team member's duties and responsibilities o How performance expectations are set	• Group discussion	• Oral evaluation	1 Hour

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration
		• Identify client expectations	• Lecture	• Written examination	
		• Perform group exercises in setting individual target/ expectation	• Demonstration • Role Play	• Observation	
		• Read instruction and requirements in up to date dissemination to members	• Lecture	• Written examination	
	2.4 Supervise team performance	• Describe listening and treating individual team members concern	• Group discussion	• Oral evaluation	1 Hour
		• Identify methods of Monitoring Performance	• Lecture	• Written examination	
		• Perform group exercises showing the skills in monitoring team performance	• Demonstration	• Observation	
3. Develop and practice negotiation skills	3.1 Identify relevant information in planning negotiations	• Describe: o codes of practice and guidelines for the organization o differences between content and process	• Group Discussion	• Oral evaluation	2 hours
		• Read: o Organizations policy and procedures for negotiations o Decision making and conflict resolution strategies procedures o Strategies to manage conflict o Steps in negotiating process	• Lecture	• Written examination	
		• Identify bargaining information	• Lecture	• Written examination	
		• Apply strategies to manage process • Apply steps in negotiating process	• Demonstration	• Observation	
	3.2 Participate in negotiations	• Describe the following strategies during negotiation: o Decision making and conflict resolution strategies procedures o Problem solving strategies on how	• Group Discussion • Case studies	• Oral evaluation	2 Hours

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration
		to deal with unexpected questions and attitudes during negotiation			
		• Practice the following scenarios in a group activity: ○ Perform interpersonal skills to develop rapport with other parties ○ Perform verbal communication and listening skill ○ observation skills ○ negotiation skills	• Demonstration • Simulation/ Role play	• Observation	
	3.3 Document areas for agreement	• Describe the Procedure in documenting negotiations	• Group Discussion • Simulation/ Role play	• Oral evaluation	2 Hours
		• Apply a filing system in managing information	• Demonstration	• Observation	
		• Demonstrate filing of documents			
4. Solve workplace problems related to work activities	4.1 Identify the problem	• Describe Normal operating parameters & product quality	• Group discussion	• Oral evaluation	2 Hours
		• Identify & clarify the nature of problem	• Lecture	• Written examination	
		• Read: ○ Brainstorming ○ Cause and effect diagrams ○ PARETO analysis ○ SWOT analysis ○ GANT chart ○ PERT CPM & graph ○ SCATTERGRAMS	• Lecture	• Written examination	
		• Apply observation, investigation and analytical techniques in solving	• Demonstration	• Observation	

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration
		problem in the workplace			
	4.2 Determine fundamental cause of the problem	• Describe Teamwork and work allocation problem	• Group discussion	• Oral evaluation	1 Hour
		• Read: o Using range of formal problem solving techniques o Enterprise goals, targets and measures o Enterprise quality, OHS and environmental requirement o Non-routine process and quality problems	• Lecture	• Written examination	
		• Perform group exercises showing safety in emergency situations and incidents	• Demonstration • Role Play	• Observation	
		• Identify & clarify the nature of problem • Select relevant equipment and operational processes	• Lecture	• Written examination	
	4.3 Determine correct / preventive action	• Describe principles of decision making strategies and techniques	• Group Discussion	• Oral evaluation	½ Hour
		• Read: o Evaluating the solution o Devising the best solution	• Lecture	• Written examination	
		• Perform group exercise how to implement the developed plan to rectify a problem	• Demonstration • Role Play	• Observation	
	4.4 Provide recommendation to manager	• Describe industry codes and standards	• Group Discussion	• Oral evaluation	½ Hour
		• Apply enterprise information systems and data collation	• Demonstration	• Observation	

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration
		• Prepare recommendation letter			
5. Use mathematical concepts and techniques	5.1 Identify mathematical tools and techniques to solve problems	• Describe the four fundamental operation (addition, subtraction, division, multiplication)	• Group Discussion	• Oral evaluation	1 Hour
		• Read: o Measurement system o Precision and accuracy o Basic measuring tools/devices	• Lecture	• Written examination	
		• Apply mathematical computations • Demonstrate activities on: o Use of calculator o Use of different measuring tools	• Demonstration	• Observation	
	5.2 Apply mathematical procedures / solution	• Read: o Estimation o Problem-based questions o Mathematical techniques	• Lecture	• Written examination	2 Hours
		• Apply mathematical computations	• Demonstration • Simulation/ Role play	• Observation	
		• Demonstrate activities on: o Use of calculator o Use of different measuring tools o Use of mathematical tools and standard formulas	• Demonstration	• Observation	

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration
	5.3 Analyze results	• Describe the four fundamental operation (addition, subtraction, division, multiplication)	• Group Discussion	• Oral evaluation	2 Hours
		• Read: o Measurement system o Precision and accuracy o Basic measuring tools/devices	• Lecture	• Written examination	
		• Apply mathematical computations • Demonstrate activities on: o Use of calculator o Use of different measuring tools	• Demonstration	• Observation	
6. Use relevant technologies	6.1 Identify appropriate technology	• Describe company policy in relation to relevant technology	• Group Discussion	• Oral evaluation	1 Hour
		• Read: o Awareness on technology and its function o Relevant technology application/ implementation o Operating instructions	• Lecture	• Written examination	
		• Practice basic communication skill in a group activity	• Demonstration • Simulation/ Role Play	• Observation	
	6.2 Apply relevant technology	• Describe different management concepts	• Group Discussion	• Oral evaluation	2 Hours
		• Read: o Relevant technology application/ implementation o Technology adaptability o Different management concepts	• Lecture	• Written examination	

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration
		○ Health and safety procedure ○ Communication techniques			
		• Apply software applications skills	• Demonstration	• Observation	
		• Practice drills on installing application software • Practice basic communication skill in a group activity	• Demonstration • Simulation/ Role Play	• Observation	
	6.3 Maintenance / enhance relevant technology	• Read: ○ Repair and maintenance procedure ○ Operating instructions	• Lecture	• Written examination	2 Hours
		• Practice drills: ○ Installing application software ○ Basic troubleshooting skills	• Demonstration • Simulation/ Role Play	• Observation	

COMMON COMPETENCIES

32 hours

This course is designed to equip individual with operational skills required for Common Construction Industry Competencies of Electrical Installation & Maintenance III with learning outcomes, methodology and assessment approach as listed herein.

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Methods	Nominal Duration
1. Use Hand Tools	1.1 Plan and prepare for tasks to be undertaken	• Identification of different types of hand tools and their uses • Function, operation and common faults in electrical/ electronic hand tools • Planning and preparing task/activity	▪ Lecture / Demonstration ▪ Distance education ▪ Film Showing	▪ Written/Oral examination ▪ Practical demonstration	1 hours
	1.2 Prepare hand tools	• Proper use of hand tools • Checking and safety requirements in handling tools • Standard procedures in checking, identification and marking of safe or unsafe/ faulty tools • Identifying and checking hand tools • Marking of safe or unsafe/ faulty hand tools	▪ Lecture / Demonstration ▪ Distance education ▪ Film Showing	▪ Written/Oral examination ▪ Practical demonstration	1 hours
	1.3 Use appropriate hand tools and test equipment.	• Safety requirements in using electronics hand tools and test equipment • Familiarizing usage of electrical/electronic hand tools for adjusting, dismantling, assembling, finishing, and cutting • Processes, Operations, Systems o Proper usage and care of hand tools o Types and uses of test equipment • Identification of common faults in the use of hand tools • Applying safety handling of hand tools and test equipment • Using appropriate hand tools and test equipment for the job requirement	▪ Lecture / Demonstration ▪ Distance education ▪ Film Showing	▪ Written/Oral examination ▪ Practical demonstration	2 hours
	1.4 Maintain hand tools	• Safety requirements in maintenance of hand tools • Processes, Operations, Systems o Maintenance of tools	▪ Lecture / Demonstration ▪ Distance education	▪ Written/Oral examination ▪ Practical	1 hours

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Methods	Nominal Duration
		○ Storage of hand tools • Procedures in maintaining hand tools • Applying 5S principles in maintenance of hand tools	▪ Film Showing	demonstration	
2. Perform Mensurations and Calculation	2.1 Select measuring instruments;	• Types of measuring tools and its uses • Selecting measuring instruments	▪ Self- paced/ modular ▪ Demonstration ▪ Small group discussion	▪ Written/Oral examination ▪ Practical demonstration	1 hours
	2.2 Carry-out measurements and calculations	• Measurements ○ Linear measurement ○ Geometrical measurement • Calculations ○ Trade Mathematics ○ Unit conversion ○ Ratio and proportion ○ Area • Interpreting formulas for volume, areas, perimeters of plane and geometric figures • Performing measurement • Computing measurement formulas	▪ Self- paced/ modular ▪ Demonstration ▪ Small group discussion	▪ Written/Oral examination ▪ Practical demonstration	2 hours
	2.3 Maintain measuring instruments	• Safe handling procedures in using measuring instruments • Procedures on maintenance of measuring instruments • Handling and maintaining measuring instruments	▪ Self- paced/ modular ▪ Demonstration ▪ Small group discussion	▪ Written/Oral examination ▪ Practical demonstration	1 hours
3. Prepare and Interpret Technical Drawing	3.1 Identify different kinds of technical drawings	• Types of technical drawings • Technical drawing applications • Mark up/Notation of Drawings • Identifying type of drawing • Evaluating mark-up/ notation of drawings • Interpreting signs and symbols	▪ Lecture ▪ demonstration ▪ Film Viewing ▪ Individualized Learning	▪ Written /oral ▪ examinations ▪ Direct observation ▪ Project method ▪ interview	1 hours

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Methods	Nominal Duration

	3.2 Interpret technical drawing	• Blueprint Reading and Plan Specification
		• Electrical/Electronic symbols and abbreviations
		• Trade Theory
		  ○ Types of electrical/electronic product plans
		  ○ Notes and specifications
		• Interpreting technical drawing and plans for electrical/electronics
		• Matching specification details with existing resources
			▪ Lecture
			▪ demonstration
			▪ Film Viewing
			▪ Individualized Learning
			▪ Direct Student Laboratory Experience
				▪ Written /oral
				▪ examinations
				▪ Direct observation
				▪ Project method
				▪ Interview
					1 hours

	3.3 Prepare/ make changes to electrical/ electronic schematics and drawings	• Freehand sketching techniques
		• Pictorial drawing
		• Drawing conventions
		• Dimensioning conventions
		• Mathematics
		  ○ Four fundamental operations
		  ○ Percentage
		  ○ Fraction
		  ○ Algebra
		  ○ Geometry
		• Sketching drawings and plans
		• Sketching pictures
		• Computing formulas
		• Using drawing instruments
			▪ Lecture
			▪ demonstration
			▪ Film Viewing
			▪ Individualized Learning
			▪ Direct Student Laboratory Experience
				▪ Written /oral
				▪ examinations
				▪ Direct observation
				▪ Project method
				▪ Interview
					2 hours

	3.4 Store technical drawings and equipment/ instruments	• Effective ways to catalogue and store technical drawings
		• Manual methods of handling, storing and maintaining paper drawings
		• Storing drawing in digital forms
		  ○ Scanner
		  ○ CAD
		• Handling and storing of drawings
		• scanning and storing drawings in digital form
		• Handling and storing drawing instruments
			▪ Lecture
			▪ demonstration
			▪ Film Viewing
			▪ Individualized Learning
			▪ Direct Student Laboratory Experience
				▪ Written /oral
				▪ examinations
				▪ Direct observation
				▪ Project method
				▪ Interview
					1 hours

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Methods	Nominal Duration
4. Apply Quality Standards	4.1 Assess quality of received materials	• Relevant production processes, materials and products • Characteristics of materials, software and hardware used in production processes • Quality checking procedures • Quality Workplace procedures • Identification of faulty materials • Checking quality of materials or component parts as per manufacturer's standards • Interpreting specifications or symbols	▪ Field trip ▪ Symposium ▪ Video clips ▪ Simulation/ Role playing ▪ On the job training	▪ Written test ▪ Demonstration & questioning ▪ Observation & questioning	1 hours
	4.2 Assess own work	• Safety and environmental aspects of production processes • Fault identification and reporting • Workplace procedure in documenting completed work • Workplace Quality Indicators • Observing safety and environmental aspects of production processes • Preparing technical reports • Performing procedures in the workplace	▪ Field trip ▪ Symposium ▪ Film showing ▪ Simulation ▪ On the job training	▪ Demonstration & questioning ▪ Observation & questioning ▪ Third party report	2 hours
	4.3 Engage in quality improvement	• Quality improvement processes • IEC/ISO standards • Environmental and safety standards • Implementing continuous improvement	▪ Field trip ▪ Symposium ▪ Film showing ▪ Simulation ▪ On the job training	▪ Demonstration & questioning ▪ Observation & questioning ▪ Third party report	2 hours
5. Terminate and Connect Electrical wiring and Electronic Circuit	5.1 Plan and prepare for termination/ connection of electrical wiring/ electronics circuits	• Use of hand tools and test instruments / equipment • Basic Electrical theory and application • OH & S guidelines and procedures • Basic electrical and electronic devices • Preparing hand tools and test equipment for termination • Preparing electrical/electronic materials for termination	▪ Film Viewing ▪ Direct Student Laboratory Experience ▪ On the Job Training ▪ Project Method	▪ Demonstration and Questioning ▪ Assessment of Output Product	1 hour

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Methods	Nominal Duration
	5.2 Terminate/ connect electrical wirings/ electronic circuits	• Electrical wirings o Wiring techniques o OH & S principles o Specifications and methods for terminating different materials • Electronics circuits o Soldering techniques and procedures o OH & S principles o Surface mount soldering techniques o Use of lead-free soldering technology • Performing different types of splices • Perform soldering techniques and procedures	▪ Film Viewing ▪ Individualized Learning ▪ Direct Student Laboratory Experience ▪ On the Job Training ▪ Project Method	▪ Demonstration and Questioning ▪ Assessment of Output Product	2 hours
	5.3 Test termination/ connections of electrical wiring/ electronics circuits	• Use of diagnostic equipment • Continuity testing and grounding o Electrical o Electronics • Functionality test o Electrical o Electronics • Performing continuity test • Performing functionality test	▪ Film Viewing ▪ Individualized Learning ▪ Direct Student Laboratory Experience ▪ On the Job Training ▪ Project Method	▪ Demonstration and Questioning ▪ Assessment of Output Product	2 hours
6. Maintain Tools and Equipment	6.1 Check condition of tools and equipment	• Read and familiarize safety practices - use of PPE - handling of tools and equipment - good housekeeping • Identity materials, tools and equipment - types and uses of lubricants - types and uses of cleaning materials - types and uses of electrical tools - types and uses of electrical equipment • Describe operational conditions of electrical tools and equipment • Maintain tools and equipment	• Lecture-demonstration • Group discussion	• Direct observation • Oral questioning	3 hours

Unit of Competency	Learning Outcomes	Learning Activities	Methodologies	Assessment Methods	Nominal Duration
		• Practice proper handling of tools and equipment • Identifying tools and equipment defects			
	6.2 Perform basic preventive maintenance	• Practice/apply safety practices - use of PPE - handling of tools and equipment - good housekeeping • Identify materials, tools and equipment - types and uses of lubricants - types and uses of cleaning materials - Methods and techniques - Procedures • Practice proper handling of tools and equipment • Schedule and carry-out preventive maintenance	• Simulation • Group discussion • Practical Lab • Demonstration	• Written test or examination • Third party report • Demonstration (able to impart knowledge and skills)	3 hours
	6.3 Store tools and equipment	• Practice/apply safety practices - use of PPE - handling of tools and equipment - good housekeeping - Storing procedures and techniques - Storage conditions/ locations • Store tools and equipment • Practice proper handling of tools and equipment	• Demonstration • Group discussion • Practical *Lab*	• Practical exam • Direct observation • Written test	2 hours

CORE COMPETENCIES

96 hours

This course is designed to equip individual with operational skills required for Core Electrical Competencies of Electrical Installation & Maintenance NC III with learning outcomes, methodology and assessment approach as listed herein. *Trainees who have completed training in or are holders of Electrical Installation & Maintenance NC II may forego training in core units of competency (1) to (3).*

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration

1. Perform roughing-in and wiring activities for three-phase distribution system for power, lighting and motor control panel	1.1 Selection of materials	• Read and familiarize:
		  ○ Types of wiring diagram based on ANSI or IEC Standard
		  ○ Types of enclosure, proofing and mounting configuration
		  ○ Types and uses of tools, materials and equipment for roughing-in activities
		• Practice proper used of safety harness
		• Interpret plan and details drawing
		• Identify and discuss the required proofing of the panel and enclosure
		• Identify and discuss the functional and defective tools, materials and equipment
			• Demonstration
			• Modular (self-paced)
			• Lecture/ Discussion
			• Audio Visual
			• Practical Laboratory
				• Oral questioning
				• Written test or examination
				• Demonstration
					4 Hrs

	1.2 Install cable tray and panel	• Interpret electrical/ mechanical drawing • Perform proper procedure in installation of cable tray and panels • Ensure that installation must accessible for maintenance purposes • Practice proper use of safety harness • Develop blueprint reading skills required to interpret work instructions • Perform the installation economically	• Demonstration • Modular (self-paced) • Lecture/ Discussion • Practical Laboratory	• Direct observation of application of tasks • Written test or examination • Demonstration with oral questioning	12 Hrs

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration

	1.3 Perform Wiring Work	• Read and familiarize:
		  ○ Wiring procedures such as cable lay-out, pulling, splicing and termination of wires
		  ○ Uses of different types of wires and cables and its application
		  ○ Application of pulling compound
		  ○ Bundling of wire size as per job requirements
		• Apply techniques in bending radius and loops tolerance
		• Practice proper handling of tools and equipment
		• Splice and terminate wires
		• Apply safety requirement for wiring works
			• Demonstration
			• Modular (self-paced)
			• Lecture/
			• Discussion
			• Audio Visual
			• Practical Laboratory
				• Direct observation of application of tasks
				• Oral questioning
				• Written test or examination
				• Demonstration
					16 Hrs

	1.4 Notify completion of work	• Read and familiarize:
		  ○ Processes, Operations Systems
		  ▪ Maintenance of tools & materials
		  ▪ Storage of tools
		• Check and conform the installation procedures based on job requirement
		• Practice good housekeeping
		• Perform commissioning activities
		• Document work
			• Demonstration
			• Modular (self-paced)
			• Lecture/ Discussion
			• Practical Laboratory
				• Direct observation of application of task
				• Written Test
				• Oral questioning
				• Demonstration
					4 Hrs.

2. Perform installation of data measurement and control system on electrical and auxiliary equipment	2.1 Plan and prepare works	• Read and familiarized:
		  ○ Type and specification of the needed devices.
		  ○ Function and the used of power supply of data measurement system and auxiliary equipment.
		• Identify the tools and materials according to the job requirements
		• Interpret plans & detail drawing
		• Practice proper handling of materials, tools and equipment
			• Demonstration
			• Modular (self-paced)
			• Lecture/ Discussion
			• Audio Visual
			• Practical Laboratory
				• Direct
				• Observation
				• Written Test
				• Demonstration
				• Oral questioning
					4 Hrs

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration
		• Check and quantify item as needed in the job requirement • Apply active and non-active test to ensure functionality.			
	1.2 Install electrical system and auxiliary equipment	• Follow procedure on installation of auxiliary equipment. • Apply proper usage of power tools and equipment in an installation. • Identify types and usage of auxiliary equipment • Practice proper usage of safety harness. • Perform splicing, dressing and harnessing of wires. • Perform termination and mounting of devices. • Perform the installation economically	• Demonstration • Modular (self-paced) • Lecture/ Discussion • Audio Visual • Practical Laboratory	• Direct observation • Written test or examination • Third party report • Demonstration with oral questioning	16 Hrs.

	1.3 Notify completion of work	• Read and familiarize:
		  ○ Processes, Operations Systems
		  ▪ Maintenance of tools & materials
		  ▪ Storage of tools
		• Check and conform the installation procedures based on job requirement
		• Practice good housekeeping
		• Perform commissioning activities
		• Document work
			• Demonstration
			• Modular (self-paced)
			• Lecture/ Discussion
			• Practical Laboratory
				• Direct observation of application of task
				• Demonstration
				• Oral questioning
					4 hrs

3. Install, assemble, test and maintain motor control system	3.1 Check/ Review type and purpose of motor control system	• Interpret electrical drawing and wiring diagram.
		• Read and familiarize:
		  ○ Function of every devices used in the line/ job requirements.
		  ○ Motor specification for the seclection of control devices.
		  ○ Type of motor control components & wiring devices
		  ○ NEMA Standard in mounting of MCC.
			• Demonstration
			• Modular (self-paced)
			• Lecture/ Discussion
			• Practical Laboratory
				• Direct observation
				• Written test or examination
				• Third party report
				• Demonstration with oral questioning
					4 Hrs

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration
		• Check and quantify the item needed in the job requirement. • Check the required rating based on its specification in accordance with standard.			
	3.2 Install and assemble motor control system	• Read and familiarize: o Lay-out and dimension of electrical drawing or wiring diagram. o Uses and functions of Electrical motor control devices o Types and operation of motor control system. o Types and uses of termination either point to point termination or terminal strip. o Proper terminal conection of motor leads outs. • Interpret electrical wiring diagram of motor control system • Perform wiring-up on the required electrical control based on the standard. • Perform procedures in connection and termination of motor terminal leads out and control devices. • Perform checking for continuity test or ohmmeter test of motor terminal. • Perform the installation economically.	• Demonstration • Modular (self-paced) • Lecture/ Discussion • Practical Laboratory	• Direct observation of application of tasks. • Oral questioning • Written test or examination • Third party report • Demonstration	16 Hrs
	3.3 Notify completion of work	• Condut performance testing for motor control system • Observe environmental requirements on waste management • Apply 5'S principles • Practice good housekeeping • Perform commissioning activities	• Demonstration • Modular (self-paced) • Lecture/ Discussion • Practical Laboratory	• Direct observation • Written test • Third party report • Demonstration with oral questioning	4 Hrs.

Unit of Competency	Learning Outcomes	Learning Activities	Methodology	Assessment Approach	Nominal Duration
	3.4 Maintain electrical motor control system	• Obseve safety practices in the use of PPE, handling of tools, instrument and equipment. • Practice good housekeeping of materials, tools and equipment • Identify types and uses of lubricants and cleaning materials • Apply methods, techniques and procedures in maintenance of motor control system • Practice proper handling of tools, instrument and equipment. • Schedule and perform preventive maintenance • Perform basic troubleshooting skills • Identify failures or defects • Implement corrective and preventive actions based on root cause of trouble.	• Demonstration • Modular (self-paced) • Lecture/ Discussion • Practical Laboratory	• Direct observation of application of tasks. • Oral questioning • Written test or examination • Third party report • Demonstration	12 Hrs

3.2 TRAINING DELIVERY

1. The delivery of training shall adhere to the design of the curriculum. Delivery shall be guided by the principles of competency-based TVET.

    a. Course design is based on competency standards set by the industry or recognized industry sector; (Learning system is driven by competencies written to industry standards)
    b. Training delivery is learner-centered and should accommodate individualized and self-paced learning strategies;
    c. Training can be done on an actual workplace setting, simulation of a workplace and/or through adoption of modern technology.
    d. Assessment is based in the collection of evidence of the performance of work to the industry required standards;
    e. Assessment of competency takes the trainee's knowledge and attitude into account but requires evidence of actual performance of the competency as the primary source of evidence.
    f. Training program allows for recognition of prior learning (RPL) or current competencies;
    g. Training completion is based on satisfactory performance of all specified competencies.

2. The competency-based TVET system recognizes various types of delivery modes, both on-and off-the-job as long as the learning is driven by the competency standards specified by the industry. The following training modalities and their variations/components may be adopted singly or in combination with other modalities when designing and delivering training programs:

    2.1. Institution- Based:

    - **Dual Training System (DTS)/Dualized Training Program (DTP**) which contain both in-school and in-industry training or fieldwork components. Details can be referred to the Implementing Rules and Regulations of the DTS Law and the TESDA Guidelines on the DTP;

    - **Distance learning** is a formal education process in which majority of the instruction occurs when the students and instructor are not in the same place. Distance learning may employ correspondence study, audio, video, computer technologies or other modern technology that can be used to facilitate learning and formal and non-formal training. Specific guidelines on this mode shall be issued by the TESDA Secretariat.

    - The **traditional classroom-based or in-center instruction** may be enhanced through use of learner-centered methods as well as laboratory or field-work components.

2.2 Enterprise-Based:

- **Formal Apprenticeship** – Training within employment involving a contract between an apprentice and an enterprise on an approved apprenticeable occupation.

- **Enterprise-based Training-** where training is implemented within the company in accordance with the requirements of the specific company. Specific guidelines on this mode shall be issued by the TESDA Secretariat.

3.3 TRAINEE ENTRY REQUIREMENTS

The trainees who wish to enter the course should possess the following requirements:

- Must be a holder and/or have undergone training in Electrical Installation and Maintenance NC II or Mechatronics Servicing NC II

This list does not include specific institutional requirements such as educational attainment, appropriate work experience, and others that may be required of the trainees by the school or training center delivering the TVET program.

3.4 LIST OF TOOLS, EQUIPMENT AND MATERIALS

Recommended list of tools, equipment and materials for the training of 25 trainees for Electrical Installation and Maintenance NC III are as follows:

TOOLS/INSTRUMENT		MATERIALS	
Qty.	**Description**	**Qty.**	**Description**
5 units	Measuring tools (e.g. Pull-push meter)	5 pcs.	Circuit breakers/Fuses (Din rail type)
5 pcs.	Crimping tools	15 pcs.	Controller/Contactors
5 pcs.	Pliers	10 pcs.	Relays (Din rail type)
5 sets	Screw drivers	5 pcs.	Timers (Din rail type)
5 sets	Wrenches (box & open)	5 pcs.	Terminal Blocks/Lugs (Din rail type)
5 pcs.	Wire splicers/strippers	15 pcs./ color	Pilot lamps (red, green, yellow)
5 pcs.	Multi-Tester/VOM	5 pcs.	Actuators/solenoids
5 units	Insulation Tester	5 pcs.	NO Push buttons (panel type)
5 pcs.	Spirit level	5 pcs.	NC Push buttons (panel type)
5 pcs.	Hack saw	5 pcs.	Selector Switches (panel type)
5 pcs.	Pipe cutter	5 lengths	Cable duct
5 pcs.	Pipe reamer	4 lengths	Din rail
5 pcs.	Pipe threader	3 packs	Wire Strap
5 pcs.	Pipe bender	5 pcs.	Wire Markers
5 pcs.	Bolt cutter	5 pack	Cable Tie
5 pcs.	Ball hammer	20 meters	Cable (Royal cord)
5 pairs	Electrician Pliers	10 pcs.	Glands/Grommet
5 pcs.	Box Wrench	2 boxes	Conductors

TOOLS/INSTRUMENT		MATERIALS	
Qty.	**Description**	**Qty.**	**Description**
5 pcs.	Wire splicer	5 rolls	Insulators
5 pcs.	Wire stripper	5 pcs.	Proper working clothes
5 pcs.	Electrician knife	300 m	TF (75m or 150m per box) or automotive wires, (30m)
5 pcs.	Tools holster	5 sets	Wiring boards, ¾'x4'x8'
5 pcs.	Push-pull 0-5 mtrs	25 pcs.	RSC/IMC
5 pcs.	Claw hammer	5 pcs.	Entrance cap
		50 Pairs.	Locknut & bushing
		100 pcs.	3/16' x 1" Metal Screw
EQUIPMENT		50 pcs.	Conduit strap/clamp
Qty.	**Description**	5 boxes	Wire AWG #12, (3.5mm2)
5 units	Multi-tester	5 boxes	Wire AWG #14(2.0mm2)
3 units	Motors, 3-phase, 220 volts	5 rolls	Electrical tape
5 units	Electric drill	5 Kgs.	#16 G.I wire
5 units	Portable grinder	1 pc.	Whiteboard 4 x 8 x ¾
2 units	Automatic Voltage Regulator (AVR)	1 pc.	Whiteboard 4 x 4 x ¾ with movable stand
3 units	Clamp-on meter	1 box	Whiteboard marker, assorted color
1 unit	Insulation Resistance Tester	2 pcs.	Whiteboard eraser magnetic
1 unit	Earth resistance tester	1 box	Push pin
1 unit	Labeling machine	1 pc.	Pencil sharpener
1 unit	Fire extinguisher KGS ABC	3 boxes	Pencil with eraser
1 unit	LCD Projector	2 kgs	Rags
1 unit	Laptop	5 ltrs	Cleaning agent liquid
		1 unit	First aid kit
PPEs		2 reams	Bond paper
Qty.	**Description**		
25 pcs.	Working gloves		
10 pairs	Safety shoes		**Forms/Manuals**
10 pcs.	Hard hat	**Qty.**	**Description**
10 pcs.	Safety goggles	As required	Motor Controller and specification
			Requisition form(s)
			Industry/Institution Quality Manual
			User's guide
			Drawings/diagrams

3.5 TRAINING FACILITIES

The building must be in compliance with occupational health and safety guidelines. Based on a class intake of 25 students/trainees, below are the space requirement & their sizes:

TEACHING/LEARNING AREAS	SIZE IN METERS	AREA IN SQ. METERS	QTY	TOTAL AREA IN SQ. METERS
Lecture Area	5 x 8	40	1	40
Laboratory Area				40
Learning Resource Area	4 x 5	20	1	20
Tool Room / Storage Area	4 x 5	20	1	20
Wash ,Toilet & Locker Room	1 x 2	2	2	4
Sub-Total				124
Facilities / Equipment / Circulation*				38
Total Area				162

**** Area requirement is equivalent to 30% of the total teaching/learning areas***

3.6 TRAINERS QUALIFICATIONS

The trainer who will handle the course must have the following qualifications:

(1) holder of NTTC I in Electrical Installation & Maintenance NC III or higher
(2) have at least 3 years relevant job/industry or teaching experience

3.7 INSTITUTIONAL ASSESSMENT

Institutional assessment is undertaken by trainees to determine their achievement of units of competency. A certificate of achievement is issued for each unit of competency.

The result of the institutional assessment may be considered as evidence for the assessment for national certification. As a matter of policy, graduates of programs registered with TESDA under this training regulation are required to undergo mandatory national competency assessment upon completion of the program.

SECTION 4. ASSESSMENT AND CERTIFICATION ARRANGEMENTS

Competency Assessment is the process of collecting evidence and making judgments whether competency has been achieved. The purpose of assessment is to confirm that an individual can perform to the standards expected at the workplace as expressed in relevant competency standards.

The assessment process is based on evidence or information gathered to prove achievement of competencies. The process may be applied to an employable unit(s) of competency in partial fulfillment of the requirements of the national qualification.

4.1. NATIONAL ASSESSMENT AND CERTIFICATION ARRANGEMENTS

4.1.1. To attain the National Qualification of Electrical Installation and Maintenance NC III, the candidate must demonstrate competence in all units listed in Section 1. Successful candidates shall be awarded a National Certificate III signed by the TESDA Director General.

4.1.2. The qualification of Electrical Installation & Maintenance NC III can be attained through demonstration of competence through project-type assessment covering all the required units of the qualification.

4.1.3. Assessment shall focus on the core units of competency. The basic and common units shall be integrated or assessed concurrently with the core units.

4.1.4. The following are qualified to apply for assessment and certification:

(1) Graduates of formal, non-formal and informal including enterprise-based education/training programs/courses

(2) Experienced Workers (wage-employed or self-employed)

4.1.5. For those holders of existing National Certificate (NC) of individuals in Electrical Installation and Maintenance NC III, automatic conversion will be implemented.

4.1.6. Clustering of competencies is not applicable.

4.1.7. Individuals who already possess Certificate of Competency (COC) in Electrical Installation and Maintenance NC III are advised to take the NC assessment for this amended TR upon expiration of their COCs.

4.1.8. The guidelines on assessment and certification are discussed in detail in the “Procedures Manual on Assessment and Certification” and “Guidelines on the Implementation of the Philippine TVET Competency Assessment and Certification System (PTCACS)”.

4.2. COMPETENCY ASSESSMENT REQUISITE

4.2.1 *Self-Assessment Guide*. The self-assessment guide (SAG) is accomplished by the candidate prior to actual competency assessment. SAG is a pre-assessment tool to help the candidate and the assessor determine what evidence is available, where gaps exist, including readiness for assessment.

This document can:

a. Identify the candidate's skills and knowledge
b. Highlight gaps in candidate's skills and knowledge
c. Provide critical guidance to the assessor and candidate on the evidence that need to be presented
d. Assist the candidate to identify key areas in which practice is needed or additional information or skills that should be gained prior`

4.2.2 *Accredited Assessment Center*. Only Assessment Center accredited by TESDA is authorized to conduct competency assessment. Assessment centers undergo a quality assured procedure for accreditation before they are authorized by TESDA to manage the assessment for National Certification.

4.2.3 *Accredited Competency Assessor*. Only accredited competency assessor is authorized to conduct assessment of competence. Competency assessors undergo a quality assured system of accreditation procedure before they are authorized by TESDA to assess the competencies of candidates for National Certification.

ELECTRICAL INSTALLATION & MAINTENANCE NC III COMPETENCY MAP

BASIC COMPETENCIES

Receive and Respond to Workplace Communication	Work with Others	Demonstrate work values	Practice basic housekeeping procedures	Participate in Workplace Communication	Work in a Team Environment	Practice career professionalism
Practice occupational health and safety procedures	**Lead Workplace Communication**	**Lead Small Teams**	**Develop and Practice Negotiating Skills**	**Solve Problems related to Work Activities**	**Use Mathematical Concepts and Techniques**	**Use Relevant Technologies**
Utilize Specialist Communication Skills	Develop Team and Individuals	Apply Problem Solving Techniques in the Workplace	Collect, analyze and organize information	Plan and Organize Work	Promote environmental protection	

COMMON COMPETENCIES

Use Hand Tools	**Perform Mensuration and Calculation**	**Prepare and Interpret Technical Drawing**	**Apply Quality Standards**	**Perform Computer Operations**
Terminate and Connect Electrical Wiring and Electronic Circuits	**Observe Procedures, Specifications and Manuals of Instructions**	**Maintain Tools and Equipment**	**Test Electronic Components**	

CORE COMPETENCIES

Prepare electrical materials and tools	Perform roughing-in activities for basic electrical lay-out	Perform installation of wiring devices for power, lights & auxiliary outlets	Perform installation of electrical wiring	Perform installation of basic electrical protection systems	Perform installation of basic auxiliary outlets and lighting fixtures
Perform commissioning on low voltage electrical systems	Perform roughing-in activities wiring and cabling works for single-phase distribution system, power, lighting and auxiliary.	Install electrical protective devices for distribution of power , lighting, auxiliary and to include lightning protection an grounding systems.	Install wiring devices of floor and wall mounted outlets, lighting fixtures/switches and auxiliary outlet.	**Perform roughing-in activities for Three-phase distribution system for power, lighting and motor**	**Perform installation of data measurement and control system on electrical and auxiliary equipment**
Install, assemble, test and maintain motor control system	Supervise/Monitor installation & maintenance on electrical systems, auxiliary including control, lighting, power and protection equipment	Perform commissioning of electrical equipment/system	Perform programming and installation of basic PLC systems		

GLOSSARY OF TERMS

GENERAL

1) **Certification -** is the process of verifying and validating the competencies of a person through assessment

2) **Certificate of Competency (COC)** – is a certification issued to individuals who pass the assessment for a single unit or cluster of units of competency

3) **Common Competencies** - are the skills and knowledge needed by all people working in a particular industry

4) **Competency** - is the possession and application of knowledge, skills and attitudes to perform work activities to the standard expected in the workplace

5) **Competency Assessment -** is the process of collecting evidence and making judgments on whether competency has been achieved

6) **Competency Standard (CS)** - is the industry-determined specification of competencies required for effective work performance

7) **Context of Assessment** - refers to the place where assessment is to be conducted or carried out

8) **Core Competencies -** are the specific skills and knowledge needed in a particular area of work - industry sector/occupation/job role

9) **Critical aspects of competency -** refers to the evidence that is essential for successful performance of the unit of competency

10) **Elective Competencies -** are the additional skills and knowledge required by the individual or enterprise for work

11) **Elements** - are the building blocks of a unit of competency. They describe in outcome terms the functions that a person performs in the workplace.

12) **Evidence Guide** - is a component of the unit of competency that defines or identifies the evidences required to determine the competence of the individual. It provides information on critical aspects of competency, underpinning knowledge, underpinning skills, resource implications, assessment method and context of assessment

13) **Level -** refers to the category of skills and knowledge required to do a job

14) **Method of Assessment** - refers to the ways of collecting evidence and when, evidence should be collected

15) **National Certificate (NC)** – is a certification issued to individuals who achieve all the required units of competency for a national qualification defined under the Training Regulations. NCs are aligned to specific levels within the PTQF

16) **Performance Criteria** - are evaluative statements that specify what is to be assessed and the required level of performance

17) **Qualification** - is a cluster of units of competencies that meets job roles and is significant in the workplace. It is also a certification awarded to a person on

successful completion of a course in recognition of having demonstrated competencies in an industry sector

18) **Range of Variables** - describes the circumstances or context in which the work is to be performed

19) **Recognition of Prior Learning (RPL)** – is the acknowledgement of an individual's skills, knowledge and attitudes gained from life and work experiences outside registered training programs

19) **Resource Implication -** refer to the resources needed for the successful performance of the work activity described in the unit of competency. It includes work environment and conditions, materials, tools and equipment

20) **Basic Competencies -** are the skills and knowledge that everyone needs for work

21) **Training Regulations (TR)** – refers to the document promulgated and issued by TESDA consisting of competency standards, national qualifications and training guidelines for specific sectors/occupations. The TR serves as basis for establishment of qualification and certification under the PTQF. It also serves as guide for development of competency-based curricula and instructional materials including registration of TVET programs offered by TVET providers

22) **Underpinning Knowledge -** refers to the competency that involves in applying knowledge to perform work activities. It includes specific knowledge that is essential to the performance of the competency

23) **Underpinning Skills** - refers to the list of the skills needed to achieve the elements and performance criteria in the unit of competency. It includes generic and industry specific skills

24) **Unit of Competency** – is a component of the competency standards stating a specific key function or role in a particular job or occupation; it is the smallest component of achievement that can be assessed and certified under the PTQF

SECTOR SPECIFIC

1) **Technical Terms**. All technical terms are used with meanings as defined in the latest published edition of the Philippine Electrical Code, in applicable laws, such as R.A. 7920 (The New Electrical Engineering Law), and current electrical engineering practice.

2) **Other Terms**. All other terms are used as defined in applicable TESDA documents.

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