TRAINING REGULATIONS

INSTRUMENTATION AND CONTROL SERVICING NC IV

ELECTRONICS SECTOR

TECHNICAL EDUCATION AND SKILLS DEVELOPMENT AUTHORITY

East Service Road, South Superhighway, Taguig City, Metro Manila

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ELECTRONICS SECTOR

INSTRUMENTATION AND CONTROL SERVICING

NATIONAL CERTIFICATE LEVEL IV

TRAINING REGULATIONS FOR
INSTRUMENTATION AND CONTROL SERVICING NC IV

SECTION 1: INSTRUMENTATION AND CONTROL SERVICING QUALIFICATIONS

The **INSTRUMENTATION AND CONTROL SERVICING NC IV** Qualification consists of competencies that a person must possess to enable him/her to startup, commission, diagnose and troubleshoot instrumentation & control devices and systems, as well as microcomputer hardware, operating systems, common user applications, network systems, and various common peripherals in a manufacturing or processing environment.

This Qualification is packaged from the competency map of the Electronics Industry (Service sector) as shown in Annex A.

The units of competency comprising this qualification include the following:

Code	BASIC COMPETENCIES
5 00 311 1 15	Utilize specialized communication skills
5 00 311 1 16	Develop teams and individuals
5 00 311 1 17	Apply problem solving techniques in the workplace
5 00 311 1 18	Collect, analyze and organize information
5 00 311 1 19	Plan and organize work
5 00 311 1 20	Promote environmental protection

Code	COMMON COMPETENCIES
ELC724201	Use Hand Tools
ELC311201	Perform Mensuration and Calculation
ELC311202	Prepare and Interpret Technical Drawing
ELC315202	Apply Quality Standards
ELC311203	Perform Computer Operations
ELC724202	Terminate and Connect Electrical Wiring and Electronic Circuits

Code	CORE COMPETENCIES
	All core units of competency in Instrumentation & Control Servicing NC II and NC III, plus
ELC724306	Start-up and Commissioning Instrumentation & Control Systems
ELC724307	Diagnose and Troubleshoot Instrumentation & Control Systems

A person who has achieved this Qualification is competent to be an:

  ➢ Instrumentation and Control Technician 4
  ➢ Process Automation Technician

SECTION 2:   **COMPETENCY STANDARDS**

This section gives the details of the contents of the basic, common, and core units of competency required for **INSTRUMENTATION AND CONTROL SERVICING NC IV.**

BASIC COMPETENCIES

UNIT OF COMPETENCY	:	**UTILIZE SPECIALIZED COMMUNICATION SKILLS**
UNIT CODE	:	**500311115**
UNIT DESCRIPTOR	:	This unit covers the knowledge, skills and attitudes required to use specialized communication skills to meet specific needs of internal and internal clients, conduct interviews, facilitate group of discussions, and contribute to the development of communication strategies.

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables
1. Meet common and specific communication needs of clients and colleagues	1.1 Specific communication needs of clients and colleagues are identified and met 1.2 Different approaches are used to meet communication needs of clients and colleagues 1.3 Conflict is addressed promptly and in a timely way and in a manner which does not compromise the standing of the organization
2. Contribute to the development of communication strategies	2.1 ***Strategies*** for internal and external dissemination of information are developed, promoted, implemented and reviewed as required 2.2 Channels of communication are established and reviewed regularly 2.3 Coaching in effective communication is provided 2.4 Work related network and relationship are maintained as necessary 2.5 Negotiation and conflict resolution strategies are used where required 2.6 Communication with clients and colleagues is appropriate to individual needs and organizational objectives
3. Represent the organization	3.1 When participating in internal or external forums, presentation is relevant, appropriately researched and presented in a manner to promote the organization 3.2 Presentation is clear and sequential and delivered within a predetermined time 3.3 Utilize appropriate media to enhance presentation 3.4 Differences in views are respected

	3.5 Written communication is consistent with organizational standards
	3.6 Inquiries are responded in a manner consistent with organizational standard
4. Facilitate group discussion	4.1 Mechanisms which enhance **effective group interaction** is defined and implemented
	4.2 Strategies which encourage all group members to participate are used routinely
	4.3 Objectives and agenda for meetings and discussions are routinely set and followed
	4.4 Relevant information is provided to group to facilitate outcomes
	4.5 Evaluation of group communication strategies is undertaken to promote participation of all parties
	4.6 Specific communication needs of individuals are identified and addressed
5. Conduct interview	5.1 A range of appropriate communication strategies are employed in **interview situations**
	5.2 Records of interviews are made and maintained in accordance with organizational procedures
	5.3 Effective questioning, listening and nonverbal communication techniques are used to ensure that required message is communicated

RANGE OF VARIABLES

VARIABLE	RANGE
1. Strategies	1.1 Recognizing own limitations 1.2 Referral to specialists 1.3 Utilizing techniques and aids 1.4 Providing written drafts 1.5 Verbal and non verbal communication
2. Effective group interaction	2.1 Identifying and evaluating what is occurring within an interaction in a non judgmental way 2.2 Using active listening 2.3 Making decision about appropriate words, behavior 2.4 Putting together response which is culturally appropriate 2.5 Expressing an individual perspective 2.6 Expressing own philosophy, ideology and background and exploring impact with relevance to communication
3. Types of Interview	3.1 Related to staff issues 3.2 Routine 3.3 Confidential 3.4 Evidential 3.5 Non disclosure 3.6 Disclosure
4. Interview situations	4.1 Establish rapport 4.2 Elicit facts and information 4.3 Facilitate resolution of issues 4.4 Develop action plans 4.5 Diffuse potentially difficult situation

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate:
	1.1 Demonstrated effective communication skills with clients accessing service and work colleagues
	1.2 Adopted relevant communication techniques and strategies to meet client particular needs and difficulties
2. Underpinning Knowledge	2.1 Communication process
	2.2 Dynamics of groups and different styles of group leadership
	2.3 Communication skills relevant to client groups
3. Underpinning Skills	3.1 Full range of communication techniques including:
	3.1.1 Full range of communication
	3.1.2 Active listening
	3.1.3 Feedback
	3.1.4 Interpretation
	3.1.5 Role boundaries setting
	3.1.6 Negotiation
	3.1.7 Establishing empathy
	3.2 Communication skills required to fulfill job roles as specified by the organization
4. Resource Implications	4.1 Access to appropriate workplace where assessment can take place
5. Methods of Assessment	Competency may be assessed through
	5.1 Direct observation
	5.2 Oral Interview
6. Context for Assessment	6.1 This unit should be assessed on the job through simulation

UNIT OF COMPETENCY : **DEVELOP TEAMS AND INDIVIDUALS**

UNIT CODE : **500311116**

UNIT DESCRIPTOR : This unit covers the skills, knowledge and attitudes required to determine individual and team development needs and facilitate the development of the workgroup.

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables
1. Provide team leadership	1.1. ***Learning and development needs*** are systematically identified and implemented in line with ***organizational requirements*** 1.2. Learning plan to meet individual and group training and developmental needs is collaboratively developed and implemented 1.3. Individuals are encouraged to self evaluate performance and identify areas for improvement 1.4. ***Feedback on performance*** of team members is collected from relevant sources and compared with established team learning process
2. Foster individual and organizational growth	2.1. Learning and development program goals and objectives are identified to match the specific knowledge and skills requirements of competency standards 2.2. ***Learning delivery methods*** are appropriate to the learning goals, the learning style of participants and availability of equipment and resources 2.3. Workplace learning opportunities and coaching/ mentoring assistance are provided to facilitate individual and team achievement of competencies 2.4. Resources and timelines required for learning activities are identified and approved in accordance with organizational requirements
3. Monitor and evaluate workplace learning	3.1. Feedback from individuals or teams is used to identify and implement improvements in future learning arrangements 3.2. Outcomes and performance of individuals/teams are assessed and recorded to determine the effectiveness of development programs and the extent of additional support 3.3. Modifications to learning plans are negotiated to improve the efficiency and effectiveness of learning 3.4. Records and reports of competency are maintained within organizational requirement

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables
4. Develop team commitment and cooperation	4.1. Open communication processes to obtain and share information is used by team 4.2. Decisions are reached by the team in accordance with its agreed roles and responsibilities 4.3. Mutual concern and camaraderie are developed in the team
5. Facilitate accomplishment of organizational goals	5.1. Team members actively participated in team activities and communication processes 5.2. Teams members developed individual and joint responsibility for their actions 5.3. Collaborative efforts are sustained to attain organizational goals

RANGE OF VARIABLES

VARIABLE	RANGE
1. Learning and development needs	1.1 Coaching, mentoring and/or supervision 1.2 Formal/informal learning program 1.3 Internal/external training provision 1.4 Work experience/exchange/opportunities 1.5 Personal study 1.6 Career planning/development 1.7 Performance appraisals 1.8 Workplace skills assessment 1.9 Recognition of prior learning
2. Organizational requirements	2.1 Quality assurance and/or procedures manuals 2.2 Goals, objectives, plans, systems and processes 2.3 Legal and organizational policy/guidelines and requirements 2.3 Safety policies, procedures and programs 2.4 Confidentiality and security requirements 2.5 Business and performance plans 2.6 Ethical standards 2.7 Quality and continuous improvement processes and standards
3. Feedback on performance	3.1 Formal/informal performance appraisals 3.2 Obtaining feedback from supervisors and colleagues 3.3 Obtaining feedback from clients 3.4 Personal and reflective behavior strategies 3.5 Routine and organizational methods for monitoring service delivery
4. Learning delivery methods	4.1 On the job coaching or mentoring 4.2 Problem solving 4.3 Presentation/demonstration 4.4 Formal course participation 4.5 Work experience 4.6 Involvement in professional networks 4.7 Conference and seminar attendance 4.8 Induction

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1. Identified and implemented learning opportunities for others 1.2. Gave and received feedback constructively 1.3. Facilitated participation of individuals in the work of the team 1.4. Negotiated learning plans to improve the effectiveness of learning 1.5. Prepared learning plans to match skill needs 1.6. Accessed and designated learning opportunities
2. Underpinning Knowledge	2.1. Coaching and mentoring principles 2.2. Understanding how to work effectively with team members who have diverse work styles, aspirations, cultures and perspective 2.3. Understanding how to facilitate team development and improvement 2.4. Understanding methods and techniques for eliciting and interpreting feedback 2.5. Understanding methods for identifying and prioritizing personal development opportunities and options 2.6. Knowledge of career paths and competency standards in the industry
3. Underpinning Skills	3.1. Ability to read and understand a variety of texts, prepare general information and documents according to target audience; spell with accuracy; use grammar and punctuation effective relationships and conflict management 3.2. Communication skills including receiving feedback and reporting, maintaining effective relationships and conflict management 3.3. Planning skills to organize required resources and equipment to meet learning needs 3.4. Coaching and mentoring skills to provide support to colleagues 3.5. Reporting skills to organize information; assess information for relevance and accuracy; identify and elaborate on learning outcomes 3.6. Facilitation skills to conduct small group training sessions 3.7. Ability to relate to people from a range of social, cultural, physical and mental backgrounds

4. Resource Implications	The following resources **MUST** be provided: 4.1. Access to relevant workplace or appropriately simulated environment where assessment can take place 4.2. Materials relevant to the proposed activity or tasks
5. Methods of Assessment	Competency may be assessed through: 5.1. Observation of work activities of the individual member in relation to the work activities of the group 5.2. Observation of simulation and or role play involving the participation of individual member to the attainment of organizational goal 5.3. Case studies and scenarios as a basis for discussion of issues and strategies in teamwork
6. Context for Assessment	6.1. Competency may be assessed in workplace or in a simulated workplace setting 6.2. Assessment shall be observed while task are being undertaken whether individually or in-group

UNIT OF COMPETENCY	:	**APPLY PROBLEM SOLVING TECHNIQUES IN THE WORKPLACE**
UNIT CODE	:	**500311117**
UNIT DESCRIPTOR	:	This competency covers the knowledge, skills and attitudes required to apply the process of problem solving and other problems beyond those associated directly with the process unit. It includes the application of structured processes and improvement tools. This competency is typically performed by an experienced technician, team leader or supervisor.

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables
1. Analyze the problem	1.1. Issues/concerns are evaluated based on data gathered 1.2. Possible causes of problem are identified within the ***area of responsibility*** as based on experience and the use of problem solving tools/analytical techniques 1.3 Possible cause statements are developed based on findings
2. Identify possible solutions	2.1 All possible options are considered for resolution of the problem in accordance with ***safety*** and operating procedures 2.2 Strengths and weaknesses of possible options are considered 2.3 Corrective action is determined to resolve the problem and its possible future causes
3. Recommend solution to higher management	3.1 Report/***communication*** or ***documentation*** are prepared 3.2 Recommendations are presented to appropriate personnel 3.3 Recommendations are followed-up, if required
4. Implement solution	4.1 Measurable objectives are identified 4.2 Resource needs are identified 4.3 Timelines are identified in accordance with plan
5. Evaluate/Monitor results and outcome	5.1. Processes and improvements are identified based on evaluative assessment of problem 5.2. Recommendations are prepared and submitted to superiors.

RANGE OF VARIABLES

VARIABLE	RANGE
1. Area of responsibility	Variables may include but are limited to: 1.1. Work environment 1.2. Problem solution processes 1.3. Preventative maintenance and diagnostic policy 1.4. Roles and technical responsibilities
2. Occupational Health and Safety	2.1. As per company, statutory and vendor requirements. Ergonomic and environmental factors must be considered during the demonstration of this competency.
3. Communication	Variables may include but are not limited to: 3.1. both hand written and printed material 3.2. internal memos 3.3. electronic mail 3.4. briefing notes and 3.5. bulletin boards.
4. Documentation	4.1. Audit trails 4.2. Naming standards 4.3. Version control

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate:
	1.1. Analyzed the problem
	1.2. Identified possible solutions
	1.3. Implemented solutions
	1.4. Recommended solutions to higher management
	1.5. Outcome evaluated/monitored
	Evidence of satisfactory performance in this unit can be obtained by observation of performance and questioning to indicate knowledge and understanding of the elements of the competency and performance criteria.
2. Underpinning Knowledge	2.1. Broad understanding of systems, organizational systems and functions
	2.2. Broad knowledge of help desk and maintenance practices
	2.3. Current industry accepted hardware and software products with broad and detailed knowledge of its general features and capabilities
	2.4. Broad knowledge of the operating system
	2.5. Broad knowledge of the client business domain
	2.6. Broad knowledge based incorporating current industry practices related to escalation procedures
	2.7. Broad knowledge based of diagnostic tools
	2.8. General principles of OHS
	2.8. Divisional/unit responsibilities
3. Underpinning Skills	3.1. Decision making within a limited range of options.
	3.2. Communication is clear, precise and varies according to the type of audience
	3.3. Teamwork in reference to personal responsibility
	3.4. Time management as applied to self-management.
	3.5. Analytical skills in relation to routine malfunctions.
	3.6. General customer service skills displayed.
	3.7. Questioning and active listening is employed to clarify general information
4. Resource Implications	4.1. 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 reasoning behind the observable actions.

5. Methods of Assessment	Competency may be assessed through: 5.1. Through direct observation of application to tasks and questions related to underpinning knowledge Under general guidance, checking various stages of operation and at the completion of the activity against performance criteria and specifications
6. Context for Assessment	6.1. Competency may be assessed in the work place or in a simulated work place setting 6.2. Assessment shall be carried out through TESDA's Accredited Assessment Centers/Venues while tasks are undertaken either individually or as part of a team under limited supervision

UNIT OF COMPETENCY :   COLLECT, ANALYZE AND ORGANIZE   INFORMATION

UNIT CODE   **: 500311118**

UNIT DESCRIPTOR   **:** This unit covers the outcomes required to process, analyze, interpret and organize workplace information and other relevant data.

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ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables
1. Study information requirements	1.1 Needs are identified using established ***research procedures*** 1.2 Relevant ***forms*** and recording systems are used to gather the information. 1.3 Respondents are selected to implement survey / research based on established procedures.
2. Process data	2.1 ***Data*** are collected and collated based on the prescribed method. 2.2 Relevant data are used as references in accordance with the objectives of the program. 2.3 ***Information*** is compiled according to the required form.
3. Analyze, interpret and organize information gathered	3.1 Data are analyzed using relevant ***methodologies*** 3.2 Where applicable, ***statistical analysis/methods*** are employed according to the objectives of the program 3.3 Graphs and other visual presentations are prepared to facilitate analysis / interpretation of information
4. Present findings/ recommendations	4.1 Findings/recommendations summarized and presented/packaged in user-friendly manner 4.2 Relevant inputs gathered to finalize report 4.3 Draft report prepared based on standard format. 4.4 Technical reports are submitted and disseminated to concerned offices.

RANGE OF VARIABLES

VARIABLE	R A N G E
1. Research procedures	May include but are not limited to: 1.1 TNA 1.2 Front-end analysis 1.3 Surveys 1.4 Interviews 1.5 Functional analysis 1.6 DACUM research
2. Forms	May include but are not limited to: 2.1 Survey forms/Questionnaires 2.2 Personal information/Profile 2.3 Accident report form 2.4 Requisition slip 2.5 Job orders 2.6 Purchase request form 2.7 Incident report form
3. Methodologies	3.1 Qualitative methods 3.2 Quantitative methods
4. Statistical analysis/methods	4.1. Averages (Mean, Median, Mode) 4.2. Percentage 4.3. Ranks 4.4. Frequency Distribution 4.5 Statistical test
5. Data	5.1. Raw Data
6. Information	6.1. Processed and packaged data

EVIDENCE GUIDE

1. Critical Aspects of Competency	Assessment requires evidence that the candidate 1.1 Determined information requirements based on organizational goals and objectives. 1.2 Used relevant forms and recording systems to gather data 1.3 Processed data based on the objectives of the program 1.4 Utilized relevant research methods based on the objective of the program 1.5 Analyzed and organized information gathered 1.6 Submitted/Disseminated technical reports to concerned offices

2. Underpinning Knowledge	2.1 Data processing, Information analysis and interpretation
	2.2 Research methods
	    2.2.1 Qualitative
	    2.2.2 Quantitative
	    2.2.3 Statistical
	2.3 Report writing
	2.4 Use of relevant software
	    2.4.1 Spreadsheets
	    2.4.2 Presentation graphics
	    2.4.3 Work processor
	    2.4.4 Statistical package

3. Underpinning Skills	3.1 Communicating effectively 3.2 Performing research and analysis 3.3 Reading / interpreting data and information 3.4 Problem solving
4. Resource Implications	The following resources **MUST** be provided: 4.1 Workplace or assessment location 4.2 Access to office equipment and facilities relevant to the unit 4.3 Case studies/scenarios
5. Methods of Assessment	Competency may be assessed through: 5.1 Written/ Oral Examination 5.2 Interviews 5.3 Portfolio
6. Context for Assessment	6.1 Competency may be assessed in actual workplace or TESDA Accredited Assessment Center

UNIT OF COMPETENCY	:	PLAN AND ORGANIZE WORK
UNIT CODE	:	500311119
UNIT DESCRIPTOR	:	This unit covers the outcomes required in planning and organizing work. It may be applied to a small independent operation or to a section of a large organization.

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables
1. Set objectives	1.1 **Objectives** are consistent with and linked to work activities in accordance with organizational aims 1.2 Objectives are stated as measurable targets with clear time frames 1.3 Support and commitment of team members are reflected in the objectives 1.4 Realistic and attainable objectives are identified
2. Plan and schedule work activities	2.1 Tasks/work activities to be completed are identified and prioritized as directed 2.2 Tasks/work activities are broken down into steps in accordance with set time frames achievable components in accordance with set time frames 2.3 **Resources** are allocated as per requirements of the activity 2.4 **Schedule of work activities** is coordinated with personnel concerned
3. Implement work plans	3.1 **Work methods and practices** are identified in consultation with personnel concerned 3.2 **Work plans** are implemented in accordance with set time frames, resources and **standards**
4. Monitor work activities	4.1 Work activities are monitored and compared with set objectives 4.2 Work performance is monitored 4.3 Deviations from work activities are reported and recommendations are coordinated with appropriate personnel and in accordance with set standards 4.4 Reporting requirements are complied with in accordance with recommended format 4.5 Observe timeliness of report 4.6 Files are established and maintained in accordance with standard operating procedures

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables
5. Review and evaluate work plans and activities	5.1 Work plans, strategies and implementation are reviewed based on accurate, relevant and current information 5.2 Review is based on comprehensive consultation with appropriate personnel on outcomes of work plans and reliable feedback 5.3 Results of review are provided to concerned parties and formed as the basis for adjustments/simplifications to be made to policies, processes and activities 5.4 Performance appraisal is conducted in accordance with organization rules and regulations 5.5 Performance appraisal report is prepared and documented regularly as per organization requirements. 5.6 Recommendations are prepared and presented to ***appropriate personnel/authorities*** 5.7 ***Feedback mechanisms*** are implemented in line with organization policies

RANGE OF VARIABLES

VARIABLE	RANGE	
1. Objectives	1.1. Specific 1.2. General	
2. Resources	2.1. Personnel 2.2. Equipment and technology 2.3. Services 2.4. Supplies and materials 2.5. Sources for accessing specialist advice 2.6. Budget	
3. Schedule of work activities	3.1. Daily 3.2. Work-based 3.3. Contractual 3.4. Regular	3.5. Confidential 3.6. Disclosure 3.7. Non-disclosure
4. Work methods and practices	Work methods and practices may include but not limited to: 4.1. Legislated regulations and codes of practice 4.2. Industry regulations and codes of practice 4.3. Occupational health and safety practices	
5. Work plans	5.1. Daily work plans 5.2. Project plans 5.3. Program plans 5.4. Organization strategic and restructuring plans	5.5. Resource plans 5.6. Skills development plans 5.7. Management strategies and objectives
6. standards	6.1. Performance targets 6.2. Performance management and appraisal systems 6.3. National competency standards 6.4. Employment contracts 6.5. Client contracts 6.6. Discipline procedures 6.7. Workplace assessment guidelines 6.8. Internal quality assurance 6.9. Internal and external accountability and auditing requirements 6.10. Training Regulation Standards 6.11. Safety Standards	
7. Appropriate personnel/authorities	Appropriate personnel include: 7.1. Management 7.2. Line Staff	
8. Feedback mechanisms	Feedback mechanisms include: 8.1. Verbal feedback 8.2. Informal feedback 8.3. Formal feedback	8.4. Questionnaire 8.5. Survey 8.6. Group discussion

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate:
	1.1. Set objectives 1.2. Planned and scheduled work activities 1.3. Implemented work plans 1.4. Monitored work activities 1.5. Reviewed and evaluated work plans and activities
2. Underpinning Knowledge	2.1. Organization's strategic plan, policies rules and regulations, laws and objectives for work unit activities and priorities 2.2. Organizations policies, strategic plans, guidelines related to the role of the work unit 2.3. Team work and consultation strategies
3. Underpinning Skills	3.1. Planning 3.2. Leading 3.3. Organizing 3.4. Coordinating 3.5. Communication Skills 3.6. Inter-and intra-person/motivation skills 3.7. Presentation skills
4. Resource Implications	The following resources **MUST** be provided 4.1. Tools, equipment and facilities appropriate to the proposed activities 4.2. Materials relevant to the proposed activities 4.3. Work plan schedules 4.4. Drawings, sketches or blueprint
5. Methods of Assessment	Competency may be assessed through: 5.1. Direct observation/questioning 5.2. Practical exercises on Planning and Scheduling Work Activities 5.3. Third Party Report (collection of competency evidence)
6. Context for Assessment	6.1. Competency may be assessed in the workplace or in simulated work

UNIT OF COMPETENCY : PROMOTE ENVIRONMENTAL PROTECTION

UNIT CODE   :   500311120

UNIT DESCRIPTOR   : This unit covers the knowledge, skills and attitudes required in adhering to environmental protection principles, strategies and guidelines

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables
1. Study guidelines for environmental concerns.	1.1 Environmental **legislations/conventions** and local ordinances are identified according to the different **environmental aspects/impact**. 1.2 **Industrial standard/environmental practices** are described according to the different environmental concerns.
2. Implement specific environmental programs.	2.1 **Programs/Activities** are identified according to organizations policies and guidelines. 2.2 Individual roles/responsibilities are determined and performed based on the activities identified. 2.4 Problems/ constraints encountered are resolved in accordance with organizations' policies and guidelines 2.5 Stakeholders are consulted based on company guidelines.
3. Monitor activities on environmental protection /programs	3.1 Activities are **periodically** monitored and evaluated according to the objectives of the environmental program 3.2 Feedback from stakeholders are gathered and considered in proposing enhancements to the program based on consultations 3.3 Data gathered are analyzed based on evaluation requirements 3.4 Recommendations are submitted based on the findings. 3.5 Management support systems are set/established to sustain and enhance the program 3.6 Environmental incidents are monitored and reported to concerned/proper authorities.

RANGE OF VARIABLES

VARIABLE	R A N G E
1. Legislations/Conventions	May include but are not limited to: 1.1 Clean Air act 1.2 Clean Water Act 1.3 Solid Waste Management 1.4 Montreal Protocol 1.5 Kyoto Protocol
2. Environmental aspects/impacts	2.1 Air pollution 2.2 Water pollution 2.3 Noise pollution 2.4 Solid waste 2.5 Flood control 2.6 Deforestation/Denudation 2.7 Radiation/Nuclear /Radio Frequency/ Microwaves 2.8 Situation 2.9 Soil erosion (e.g. Quarrying, Mining, etc.) 2.10 Coral reef/marine life protection
3. Industrial standards/ Environmental practices	3.1 ECC standards 3.2 ISO standards 3.3 company environmental management systems (EMS)
4. Periodic	4.1 hourly 4.2 daily 4.3 weekly 4.4 monthly 4.5 quarterly 4.6 yearly
5. Programs/Activities	5.1 Waste disposal (on-site and off-site) 5.2 Repair and maintenance of equipment 5.3 Treatment and disposal operations 5.4 Clean-up activities 5.5 Laboratory and analytical test 5.6 Monitoring and evaluation 5.7 Environmental advocacy programs

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Demonstrated knowledge of environmental legislations and local ordinances according to the different environmental issues/concerns. 1.2 Described industrial standard environmental practices according to the different environmental issues/concerns. 1.3 Resolved problems/ constraints encountered based on management standard procedures 1.4 Implemented and monitored environmental practices on a periodic basis as per company guidelines 1.5 Recommended solutions for the improvement of the program 1.6 Monitored and reported to proper authorities any environmental incidents
2. Underpinning Knowledge	2.1 Features of an environmental management strategy 2.2 Environmental issues/concerns 2.3 International Environmental Protocols (Montreal, Kyoto) 2.4 Waste minimization hierarchy 2.5 Environmental planning/management 2.6 Community needs and expectations 2.7 Resource availability 2.8 Environment-friendly/environmental advocates 2.9 5S of Good Housekeeping 2.10 3Rs – Reduce, Reuse & Recycle 2.11 Sanitary Code 2.12 Environmental Code of practice
3. Underpinning Skills	3.1 Communicating effectively 3.2 Performing research and analysis 3.3 Reading / interpreting data and information 3.4 Problem solving
4. Resource Implications	The following resources **MUST** be provided: 4.1 Workplace/Assessment location 4.2 Legislation, policies, procedures, protocols and local ordinances relating to environmental protection 4.3 Case studies/scenarios relating to environmental protection
5. Methods of Assessment	Competency may be assessed through: 5.1 Written/ Oral Examination 5.2 Interview/Third Party Reports 5.3 Portfolio (citations/awards from GOs and NGOs, certificate of training – local and abroad) 5.4 Simulations and role-plays
6. Context for Assessment	6.1 Competency may be assessed in actual workplace or at the designated TESDA center.

COMMON COMPETENCIES

UNIT TITLE **:** **USE HAND TOOLS**
UNIT CODE **:** **ELC724201**
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
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
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
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
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

RANGE OF VARIABLES

VARIABLE	RANGE
1. Hand tools	1.1. Hand tools for adjusting, dismantling, assembling, finishing, 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. Underpinning knowledge	2.1. Safety
	   2.1.1. Safety requirements in handling tools
	 2.2. Tools :
	   2.2.1. Function, Operation, Common faults
	 2.3. Processes, Operations, Systems
	   2.3.1. Maintenance of tools
	   2.3.2. Storage of Tools

3. Underpinning skills	3.1. Reading skills required to interpret work instruction and numerical skills 3.2. Communication skills 3.3. Problem solving in emergency situation
4. Method of assessment	Competency in this unit must be assessed through: 4.1. Observation 4.2. Oral questioning

5. Resource Implication	5.1. Tools may include the following but not limited to:
	   5.1.1. screw drivers
	   5.1.2. pliers
	   5.1.3. punches
	   5.1.4. wrenches, files

6. Context of Assessment	6.1. 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
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
2. Carry out measurements and calculation	2.1. Appropriate *measuring instrument* is selected to achieve required outcome 2.2. Accurate measurements are obtained for job 2.3. *Calculation* needed to complete work tasks are performed using the four basic process of addition (+), subtraction (-), multiplication (x), and division (/) 2.4. Calculation involving fractions, percentages and mixed numbers are used to complete workplace tasks. 2.5. Numerical computation is self-checked and corrected for accuracy 2.6. Instruments are read to the limit of accuracy of the tool.
3. Maintain measuring instruments	3.1. Measuring instruments are not dropped to avoid damage 3.2. Measuring instruments are cleaned before and after using. 3.3. Proper storage of instruments undertaken according to manufacturer's specifications and standard operating procedures.

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. Underpinning knowledge	2.1. Types of measuring instruments and their uses 2.2. Safe handling procedures in using measuring instruments 2.3. Four fundamental operation of mathematics 2.4. Formula for volume, area, perimeter and other geometric figures
3. Underpinning skills	3.1. Reading skills required to interpret work instruction 3.2. Communication skills 3.3. Handling measuring instruments 3.4. Performing mathematical calculations using the four fundamental operations 3.5. Visualizing objects and shapes 3.6. Interpreting formulae
4. Method of assessment	Competency in this unit must be assessed through: 4.1. Observation 4.2. Oral questioning
5. Resource implication	5.1. Place of assessment 5.2. Measuring instruments 5.3. Straight edge 5.4. Torque gauge 5.5. Try square 5.6. Protractor 5.7. Combination gauge 5.8. Steel rule
6. Context of Assessment	6.1. Assessment may be conducted in the workplace or in a simulated work 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
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
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.
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.
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.

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. Underpinning knowledge	2.1. Drawing conventions
	 2.2. Symbols
	 2.3. Dimensioning Conventions
	 2.4. Mark up/Notation of Drawings
	 2.5. Mathematics
	     2.5.1. Four fundamental operations
	     2.5.2. Percentage
	     2.5.3. Fraction
	     2.5.4. Trigonometric Functions
	     2.5.5. Algebra
	     2.5.6. Geometry

3. Underpinning skills	3.1. Reading skills required to interpret work instruction 3.2. Communication skills 3.3. Interpreting electrical/electronic signs and symbols
4. Method of assessment	Competency in this unit must be assessed through: 4.1. Practical tasks involving interpretation of a range of technical drawings 4.2. Oral questioning
5. Resource implication	5.1. Drawings 5.2. Diagrams 5.3. Charts 5.4. Plans
6. Context of Assessment	Assessment may be conducted in the workplace or in a simulated work environment

UNIT TITLE : **APPLY QUALITY STANDARDS**
UNIT CODE : **ELC315202**

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
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
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
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

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 requires evidence 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. Underpinning knowledge	2.1. Relevant production processes, materials and products
	2.2. Characteristics of materials/component parts used in electronic production processes
	2.3. Quality checking procedures
	2.4. Workplace procedures
	2.5. Safety and environmental aspects of production processes
	2.6. Fault identification and reporting
	2.7. Quality improvement process
3. Underpinning skills	3.1. Reading skills required to interpret work instruction
	3.2. Communication skills needed to interpret and apply defined work procedures
	3.3. Carry out work in accordance with OHS policies and procedures
4. Method of assessment	4.1. The assessor may select two (2) of the following assessment methods to objectively assess the candidate: 4.1.1. Observation 4.1.2. Questioning 4.1.3. Practical demonstration
5. Resource implication	5.1. Materials and component parts and equipment to be used in a real or simulated electronic production situation
6. Context of Assessment	6.1. Assessment may be conducted in the workplace or in a simulated work environment.

UNIT TITLE : **PERFORM COMPUTER OPERATIONS**
UNIT CODE : **ELC311203**
UNIT DESCRIPTOR : This unit covers the knowledge, skills, (and) attitudes and values needed to perform computer operations which include inputting, accessing, producing and transferring data using the appropriate hardware and software

ELEMENT	PERFORMANCE CRITERIA *Italicized Bold* terms are elaborated in the Range of Variables
1. Plan and prepare for task to be undertaken	1.1. Requirements of task are determined 1.2. Appropriate *hardware* and *software* are selected according to task assigned and required outcome 1.3. Task is planned to ensure *OH & S guidelines* and procedures are followed
2. Input data into computer	2.1. Data are entered into the computer using appropriate program/application in accordance with company procedures 2.2. Accuracy of information is checked and information is saved in accordance with standard operating procedures 2.3. Inputted data are stored in *storage media* according to requirements 2.4. Work is performed within *ergonomic guidelines*
3. Access information using computer	3.1. Correct program/application is selected based on job requirements 3.2. Program/application containing the information required is accessed according to company procedures 3.3. *Desktop icons* are correctly selected, opened and closed for navigation purposes 3.4. Keyboard techniques are carried out in line with OH & S requirements for safe use of keyboards
4. Produce/output data using computer system	4.1. Entered data are processed using appropriate software commands 4.2. Data printed out as required using computer hardware/peripheral devices in accordance with standard operating procedures 4.3. Files, data are transferred between compatible systems using computer software, hardware/ peripheral devices in accordance with standard operating procedures
5. Maintain computer equipment and systems	5.1. Systems for cleaning, minor *maintenance* and replacement of consumables are implemented 5.2. Procedures for ensuring security of data, including regular back-ups and virus checks are implemented in accordance with standard operating procedures 5.3. Basic file maintenance procedures are implemented in line with the standard operating procedures

RANGE OF VARIABLES

VARIABLE	RANGE
1. Hardware and peripheral devices	1.1. Personal computers 1.2. Networked systems 1.3. Communication equipment 1.4. Printers 1.5. Scanners 1.6. Keyboard 1.7. Mouse
2. Software	Software include the following but not limited to: 2.1. Word processing packages 2.2. Data base packages 2.3. Internet 2.4. Spreadsheets
3. OH & S guidelines	3.1. OHS guidelines 3.2. Enterprise procedures
4. Storage media	Storage media include the following but not limited to: 4.1. diskettes 4.2. CDs 4.3. zip disks 4.4. hard disk drives, local and remote
5. Ergonomic guidelines	5.1. Types of equipment used 5.2. Appropriate furniture 5.3. Seating posture 5.4. Lifting posture 5.5. Visual display unit screen brightness
6. Desktop icons	Icons include the following but not limited to: 6.1. directories/folders 6.2. files 6.3. network devices 6.4. recycle bin
7. Maintenance	7.1. Creating more space in the hard disk 7.2. Reviewing programs 7.3. Deleting unwanted files 7.4. Backing up files 7.5. Checking hard drive for errors 7.6. Using up to date anti-virus programs 7.7. Cleaning dust from internal and external surfaces

EVIDENCE GUIDE

1. Critical aspect of competency	Assessment requires evidence that the candidate: 1.1. Selected and used hardware components correctly and according to the task requirement 1.2. Identified and explain the functions of both hardware and software used, their general features and capabilities 1.3. Produced accurate and complete data in accordance with the requirements 1.4. Used appropriate devices and procedures to transfer files/data accurately 1.5. Maintained computer system
2. Underpinning knowledge	2.1. Basic ergonomics of keyboard and computer use 2.2. Main types of computers and basic features of different operating systems 2.3. Main parts of a computer 2.4. Storage devices and basic categories of memory 2.5. Relevant types of software 2.6. General security 2.7. Viruses 2.8. OH & S principles and responsibilities 2.9. Calculating computer capacity
3. Underpinning skills	3.1. Reading skills required to interpret work instruction 3.2. Communication skills
4. Method of assessment	4.1. The assessor may select two of the following assessment methods to objectively assess the candidate: 4.1.1. Observation 4.1.2. Questioning 4.1.3. Practical demonstration
5. Resource implication	5.1. Computer hardware with peripherals 5.2. Appropriate software
6. Context of Assessment	6.1. Assessment may be conducted in the workplace or in a simulated work environment

UNIT TITLE : **TERMINATE AND CONNECT ELECTRICAL WIRING AND ELECTRONICS CIRCUIT**
UNIT CODE : **ELC724202**
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
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
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. All work 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. Confirm termination/connection undertaken successfully in accordance with job specification
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

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. Underpinning knowledge	2.1. Use of tools
	2.2. Use of test instruments/equipment
	2.3. Electrical theory
	2.4. Single phase AC principles
	2.5. Wiring techniques
	2.6. DC power supplies
	2.7. Soldering
3. Underpinning skills	3.1. Reading skills required to interpret work instruction
	3.2. Communication skills
	3.3. Soldering techniques
4. Method of assessment	4.1. The assessor may select two (2) of the following assessment methods to objectively assess the candidate:
	4.1.1. Observation
	4.1.2. Oral Questioning
	4.1.3. Practical demonstration
5. Resource implication	5.1. Tools for measuring, cutting, drilling, assembling/disassembling, connecting. Tool set includes the following but not limited to:
	5.1.1. screw drivers
	5.1.2. pliers
	5.1.3. cutters
6. Context of Assessment	6.1. Assessment may be conducted in the workplace or in a simulated work environment

CORE COMPETENCIES

UNIT TITLE   :   **START-UP & COMMISSSION INSTRUMENTATION AND CONTROL SYSTEMS**

UNIT CODE   :   **ELC724306**

UNIT DESCRIPTOR :   This unit covers the knowledge, skills and attitudes necessary to undertake start-up & commissioning of instrumentation and control systems.

ELEMENTS	PERFORMANCE CRITERIA *Italicized Bold* terms are elaborated in the Range of Variables
1. Plan and prepare to undertake start-up and commissioning process	1.1. Start-up & Commissioning procedures are planned and prepared in line with job requirements. 1.2. ***OH & S policies and procedures*** are followed in line with job requirements. 1.3. ***Instrumentation and Control standards*** are followed in line with job requirements 1.4. Start-up and commissioning procedures of ***instrumentation and control systems*** are checked against specifications and requirements 1.5. ***Tools***, ***equipment*** and ***testing devices*** needed to carry out the start-up commissioning work are obtained in accordance with established procedures and checked for correct operation and safety. 1.6. ***Materials*** necessary to complete the work are obtained in accordance with job requirements
2. Start-up and commission instrumentation and control systems	2.1. Appropriate ***personal protective equipment*** is used in line with standard procedures. 2.2. Start-up and commissioning is done using specified procedures 2.3. Work is performed in accordance with requirements without damage to the surrounding environment or services 2.4. Unplanned events or conditions are responded to in accordance with established procedures
3. Check commissioned systems and equipment	3.1. Commissioned systems are verified according to established procedures. 3.2. Commissioned systems are checked to ensure safety. 3.3. Unplanned events or conditions are responded to in accordance with established procedures. 3.4. Report is prepared and completed according to the company procedures.

RANGE OF VARIABLES

VARIABLE	RANGE
1. OH & S policies and procedures	1.1. OH & S guidelines 1.2. Philippine environmental standards
2. Instrumentation and Control Standards	Include but not limited to: 2.1. ISA (Instrumentation, Systems and Automation) Society (formerly Instrument Society of America) 2.2. ANSI (American National Standards Institute) 2.3. ASME (American Society of Mechanical Engineers) 2.4. NEC (National Electrical Code) 2.5. IEC (International Electrotechnical Commission)
3. Instrumentation and Control Systems	Include a combination of the following but not limited to: 3.1. Pressure measurement and control loop 3.2. Level measurement and control loop 3.3. Flow measurement and control loop 3.4. Temperature measurement and control loop 3.5. Analytical measurement and control loop
4. Tools	Tool set includes but not limited to: 4.1. Pliers (assorted) 4.2. Screw drivers (assorted) 4.3. Soldering iron/gun 4.4. Wrenches
5. Equipment/testing devices	5.1. Equipment includes but not limited to: 5.1.1. Communication equipment (e.g. 2-way radio, cell phone) 5.1.2 Configurator or programmer 5.2. Testing devices includes but not limited to: 5.2.1. Multimeter 5.2.2. Calibrators 5.2.3. Signal simulators
6. Materials	Include but not limited to: 6.1. Sealing materials 6.2. Pipes/tubes & fittings 6.3. Wires and cables
7. Personal protective equipment	Includes but not limited to: 7.1. Ear muffs/plugs 7.2. Goggles/glasses/face shield 7.3. Safety hat 7.4. Safety apparel/suit 7.5. Safety belt/harness 7.6. Safety shoes 7.7. Mask 7.8. Gloves

EVIDENCE GUIDE

1. Critical aspect of competency	Assessment requires evidence that the candidate:
	1.1. Interpreted work instructions according to job requirements.
	1.2. Applied the appropriate/correct procedures in commissioning instrumentation and control system
	1.3. Checked the commissioned instrumentation and control systems to insure safety
	1.4. Documented the tasks undertaken
2. Underpinning knowledge	Include but not limited to:
	2.1. Occupational health and safety
	2.2. Instrumentation & Control standards
	2.3. Use of tools
	2.4. Mathematical calculations
	2.5. Electrical theory
	2.6. Electronics theory
	2.7. Use of test equipment and calibrators
	2.8. Wiring techniques
	2.9. Drawing interpretation
	2.10. Soldering techniques
	2.11. Principles of Instrumentation
	2.12. Process variable measurements (pressure, level, flow, temperature, analysis, etc.)
	2.13. Process Control Theory
	2.14. Process Control System (single-loop & multi-loop controllers, DCS, DAS, SCADA, etc)
	2.15. Sensors, transmitters, transducers & converters
	2.16. Programmable logic controllers
	2.17. Control valves and final control elements
	2.18. Computer operations
	2.19. Process and machinery operation
3. Underpinning skills	3.1. Reading skills required to interpret work instructions
	3.2. Communication skills needed to interpret and define work procedures
	3.3. Selection & use of proper tools & equipment
	3.4. Start-up & commissioning skills
	3.5. Problem solving in unplanned events

4. Method of assessment	The assessor may select at least three of the following assessment methods to objectively assess the candidate: 4.1. Observation 4.2. Questioning 4.3. Third Party 4.4. Portfolio	
5. Resource Implication	5. Include but not limited to: 5.1. Instrumentation & Control devices 5.2. Tools 5.3. Test equipment and calibrators 5.4. Materials 5.5. PPE 5.6. Technical manuals 5.7. Instrumentation & Control drawings	
6. Context of Assessment	6.1. Assessment may be conducted in the workplace or in a simulated work environment	

UNIT TITLE : **DIAGNOSE AND TROUBLESHOOT INSTRUMENTATION AND CONTROL SYSTEMS**

UNIT CODE : **ELC724307**

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes needed to diagnose and troubleshoot defects in instrumentation and control systems.

ELEMENTS	PERFORMANCE CRITERIA *Italicized Bold* terms are elaborated in the Range of Variables
1. Plan and prepare for diagnosis of faults of instrumentation and control systems	1.1. Diagnosis of faults is planned and prepared in line with job requirements 1.2. *OH & S policies and procedures* are followed in line with job requirements 1.3. *Instrumentation and Control standards* are followed in line with the job requirements 1.4. Appropriate personnel are consulted to ensure that the work is effectively coordinated 1.5. *Materials* necessary to complete the work are obtained in accordance with established procedures and checked against job requirements 1.6. *Tools, equipment and testing devices* needed to carry out the work are obtained in accordance with established procedures and checked for proper operation and safety. 1.7. *Instrumentation and control systems* defects are checked against job requirements.
2. Diagnose faults of instrumentation and control systems	2.1. Appropriate *personal protective equipment* is used in line with standard procedures. 2.2. **Faults or problems** in the instrumentation and control systems are diagnosed according to requirements and in line with the standard procedures. 2.3. Contingency measures are managed and implemented in accordance with established procedures 2.4. Unplanned events or conditions are responded to in accordance with established procedures
3. Rectify/correct defects in instrumentation and control systems	3.1. Appropriate personal protective equipment is used in line with standard procedures. 3.2. Systems and associated equipment are isolated where necessary, in accordance with established procedures 3.3. Adjustments, if necessary are made in accordance with established procedures 3.4. Defective components or parts are replaced or corrected without damage to the surrounding environment or services 3.5. Unplanned events or conditions are responded to in accordance with established procedures.

4. Test diagnosed & corrected Instrumentation & Control systems	4.1. Instrumentation & control systems are tested to ensure safe operation.
	4.2. Instrumentation & control systems are tested using standard testing procedures
	4.3. Unplanned events or conditions are responded to in accordance with established procedures.
	4.4. Report/s are prepared and completed according to company policy

RANGE OF VARIABLES

VARIABLE	RANGE
1. OH & S policies and procedures	1.1. OH & S guidelines 1.2. Philippine environmental standards
2. Instrumentation and Control Standards	Include but not limited to: 2.1. ISA (Instrumentation, Systems and Automation) Society (formerly Instrument Society of America) 2.2. ANSI(American National Standards Institute) 2.3. ASME (American Society of Mechanical Engineers) 2.4. NEC (National Electrical Code) 2.5. IEC (International Electrotechnical Commission)
3. Materials	Include but not limited to: 3.1. Sealing materials 3.2. Pipes/tubes & fittings 3.3. Wires and cables
4. Tools	Tools for: cutting, shaping, drilling, threading, tapping, finishing, dismantling/assembling. Tool set include but not limited to: 4.1. Pliers (assorted) 4.2. Screw drivers (assorted) 4.3. Soldering iron/gun 4.4. Wrenches

5. Equipment/testing devices	5.1. Equipment include but not limited to:
	    5.1.1. Communication equipment (e.g. 2-way radio, cell phone)
	    5.1.2. Configurator or programmer
	5.2. Testing devices includes but not limited to:
	    5.2.1. Multimeter
	    5.2.2. Calibrators
	    5.2.3. Signal generators
	    5.2.4. Oscilloscope

6. Instrumentation and Control Systems	Include a combination of the following but not limited to: 6.1. Pressure measurement and Control loop 6.2. Level measurement and control loop 6.3. Flow measurement and control loop 6.4. Temperature measurement and control loop 6.5. Analytical measurement and control loop
7. Personal protective equipment	Includes the following but not limited to: 7.1. Ear muffs/plugs 7.5. Safety belt/harness 7.2. Goggles/glasses/face shield 7.6. Safety shoes 7.7. Mask 7.3. Safety hat 7.8. Gloves 7.4. Safety apparel/suit
8. Faults or problems	8.1. mechanical 8.3. electronics 8.2. electrical 8.4. computer-based

EVIDENCE GUIDE

1. Critical aspect of competency	Assessment requires evidence that the candidate:
	1.1. Interpreted work instructions according to job requirements.
	1.2. Accurately diagnosed the defects in the instrumentation and control systems
	1.3. Properly adjusted/corrected the Instrumentation & Control systems identified
	1.4. Checked the diagnosed & corrected systems to insure safety
	1.5. Documented the tasks undertaken
2. Underpinning knowledge	Includes but not limited to:
	2.1. Occupational health and safety
	2.2. Instrumentation & Control standards
	2.3. Use of tools
	2.4. Mathematical calculations
	2.5. Electrical theory
	2.6. Electronics theory
	2.7. Use of test equipment and calibrators
	2.8. Wiring techniques
	2.9. Drawing interpretation
	2.10. Soldering techniques
	2.11. Principles of Instrumentation
	2.12. Process variable measurements (pressure, level, flow, temperature, analysis, etc.)
	2.13. Process Control Theory
	2.14. Process Control System (single-loop & multi-loop controllers, DCS, DAS, SCADA, etc)
	2.15. Sensors, transmitters, transducers & converters
	2.16. Programmable logic controllers
	2.17. Control valves and final control elements
	2.18. Computer operations
	2.19. Process and machinery operation
	2.20. Preventive & predictive maintenance procedures
3. Underpinning skills	3.1. Reading skills required to interpret work instructions
	3.2. Communication skills needed to interpret and define work procedures
	3.3. Selection & use of proper tools & equipment
	3.4. System diagnostics & troubleshooting skills
	3.5. Problem solving in unplanned events.
4. Method of assessment	The assessor may select at least three of the following assessment methods to objectively assess the candidate:
	4.1. Observation
	4.2. Demonstration
	4.3. Questioning
	4.4. Third Party
	4.5. Portfolio

5.	Resource Implication	Includes but not limited to: 5.1. Instrumentation & Control devices 5.2. Tools 5.3. Test equipment, calibrators, configurator or programmer 5.4. Materials 5.5. PPE 5.6. Technical manuals 5.7. Instrumentation & Control drawings
6.	Context of Assessment	6.1. Assessment may be conducted in the workplace or in a simulated work environment

SECTION 3 TRAINING STANDARDS

3.1   CURRICULUM DESIGN

Course Title: Instrumentation & Control Servicing   **NC Level:** NC IV

Nominal Training Duration: 30 hrs – Basic Competencies
                                        60 hrs – Common Competencies
                                        80 hrs – Core Competencies
                                        ----
                                        170 hrs

Course Description:

This course is designed to develop & enhance the knowledge, skills, & attitudes of an Instrumentation & Control Technician, in accordance with industry standards. It covers the basic & common competencies in addition to the core competencies such as start-up & commissioning Instrumentation & Control devices, and diagnosing & troubleshooting Instrumentation & Control systems. *The nominal duration of 170 hrs. covers only the basic, common and core units at Instrumentation & Control Servicing NC IV. TVET providers can however, offer a longer, ladderized course covering Instrumentation & Control Servicing NC II, NC III and NC IV basic, common and core units.*

BASIC COMPETENCIES
30 hrs

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
1. Utilize specialized communication skills	1.1 Meet common and specific communication needs of clients and colleagues 1.2 Contribute to the development of communication strategies 1.3 Represent the organization 1.4 Facilitate group discussion 1.5 Conduct interview	• Group discussion • Role Play • Brainstorming	• Observation • Interviews
2. Develop teams and individuals	2.1 Provide team leadership 2.2 Foster individual and organizational growth 2.3 Monitor and evaluate workplace learning 2.4 Develop team commitment and cooperation 2.5 Facilitate accomplishment of organizational goals	• Lecture • Demonstration • Self-paced (modular)	• Demonstration • Case studies

3. Apply problem solving techniques in the workplace	3.1 Analyze the problem 3.2 Identify possible solutions 3.3 Recommend solution to higher management 3.4 Implement solution 3.5 Evaluate/Monitor results and outcome	• Direct observation • Simulation/role playing • Case studies	• Written test • Practical/ performance test
4. Collect, analyze and organize information	4.1 Study information requirements 4.2 Process data 4.3 Analyze, interpret and organize information gathered 4.4 Present findings/ Recommendations	• Direct observation • Simulation/role playing • Case studies	• Written test • Practical/ performance test
5. Plan and organize work	5.1 Set objectives 5.2 Plan and schedule work activities 5.3 Implement work plans 5.4 Monitor work activities 5.5 Review and evaluate work plans and activities	• Direct observation • Simulation/role playing • Case studies	• Written test • Practical/ performance test
6. Promote environmental protection	6.1 Study guidelines for environmental concerns 6.2 Implement specific environmental programs 6.3 Monitor activities on environmental protection /programs	• Direct observation • Simulation/role playing • Case studies	• Written test • Practical/ performance test

COMMON COMPETENCIES
60 hrs

Note: *Those who have completed the course on Instrumentation and Control Servicing NC III or have acquired the Instrumentation and Control Servicing NC III qualification can skip this portion on common competencies.*

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
1. Apply Quality Standards	1.1 Asses quality of received materials 1.2 Assess own work 1.3 Engage in quality improvement	• Field trip • Symposium • Film showing • Simulation • On the job training	• Demonstration and questioning • Observation and questioning • Third party report
2 Perform Computer Operation	2.1 Set-up workstation 2.2 Prepare storage media 2.3 Work with files and objects	• Modular • Film showing • Computer	• Demonstration and questioning • Observation and questioning

		2.4 Manipulate word processing software 2.5 Manipulate spreadsheet software 2.6 Manipulate customize and database applications 2.7 Utilize the internet 2.8 Maintain computer hardware and software	based training (e-learning) • Project method • On the job training	• Third party report • Assessment of output product • Portfolio • Computer based assessment
3	Use Hand Tools	3.1 Identify, explain and apply the use of different types of hand tools 3.2 Perform basic maintenance and proper storage of hand tools according to the standard operating procedures 3.3 Document and record the sequence of events in safe keeping hand tools.	• Lecture / Demonstration • Distance education • Film Showing	• Written/Oral examination • Practical demonstration
4	Perform Mensurations and Calculation	4.1 Select measuring instruments; 4.2 2. Carry-out measurements and calculations;	• Self- paced / modular • Demonstration • Small group discussion • Distance education	• Written/Oral examination • Practical demonstration
5	Interpret Technical Drawings And Plans	5.1 Select and interpret technical drawing 5.2 Perform freehand sketching	• Lecture/ demonstration • Dualized • Distance learning	• Written /oral examinations • Direct • observation • Project method • interview
6	Terminate and Connect Electrical wiring and Electronic Circuit	6.1 Terminate or join non-soldered connections 6.2 Terminate or join soldered connections	• Film Viewing • Individualized Learning • Direct Student Laboratory Experience • On the Job Training • Project Method	• Demonstration and Questioning • Assessment of Output Product

CORE COMPETENCIES
80 hours

Note: *This course design covers only Instrumentation & Control Servicing NC level IV core units. The trainee attending this course must have completed first both the units for Instrumentation & Control Servicing NC II and NC III.*

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
1. Start-up & Commission Instrumentation & Control Devices	1.1 Read & interpret work instructions according to job requirements.	• Lecture • Discussion • Demonstration • Viewing multimedia	• Written exam • Practical exam Observation in workplace • Interviews/ questioning
	1.2 Identify the tools, equipment, testing devices, & materials needed for start-up & commissioning.		
	1.3 Identify the PPE & OHS policies & procedures required for the start-up & commissioning job.		
	1.4 Start-up & commission Instrumentation & control devices according to technical requirements & standards		
	1.5 Conduct functional test procedure of the started-up & commissioned Instrumentation & Control devices		
	1.6 Prepare a start-up & commissioning report		
2. Diagnose & Troubleshoot Instrumentation & Control Systems	2.1 Read & interpret work instructions according to the system diagnostics & troubleshooting job.	• Lecture • Discussion • Demonstration • Viewing multimedia	• Written exam • Practical exam • Observation in workplace • Interviews/ questioning
	2.2 Identify the tools, equipment, testing devices, & materials needed for system diagnostics & troubleshooting		
	2.3 Identify the PPE & OHS policies & procedures required for the system diagnostics & troubleshooting job.		
	2.4 Diagnose Instrumentation & control systems according to technical requirements & standards		
	2.5 Isolate systems & associated equipment necessary to implement corrective action		
	2.6 Rectify & correct defects in instrumentation & control systems		
	2.7 Conduct tests & inspection to determine normal functionality & to insure safe operation.		
	2.8 Prepare a system diagnostics & troubleshooting report		

3.2   TRAINING DELIVERY

The delivery of training should adhere to the design of the curriculum. Delivery should be guided by the 10 basic principles of the competency-based TVET.

- The training is based on curriculum developed from the competency standards;
- Learning is modular in its structure;
- Training delivery is individualized and self-paced;
- Training is based on work that must be performed;
- Training materials are directly related to the competency standards and the curriculum modules;
- Assessment is based in the collection of evidence of the performance of work to the industry required standard;
- Training is based both on and off-the-job components;
- Allows for recognition of prior learning (RPL) or current competencies;
- Training allows for multiple entry and exit; and
- Approved training programs are nationally accredited.

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 may be adopted when designing training programs:

- The dualized mode of training delivery is preferred and recommended. Thus programs would contain both in-school and in-industry training or fieldwork components.   Details can be referred to the Dual Training System (DTS) Implementing Rules and Regulations.

- Modular/self-paced learning is a competency-based training modality wherein the trainee is allowed to progress at his own pace.   The trainer only facilitates the training delivery.

- Peer teaching/mentoring is a training modality wherein fast learners are given the opportunity to assist the slow learners.

- Supervised industry training or on-the-job training is an approach in training designed to enhance the knowledge and skills of the trainee through actual experience in the workplace to acquire a specific competencies prescribed in the training regulations.

- Distance learning is a formal education process in which majority of the instruction occurs when the students and instructors are not in the same place.   Distance learning may employ correspondence study, or audio, video or computer technologies.

3.3 TRAINEE ENTRY REQUIREMENTS

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

- *Must have completed training in Instrumentation & Control Servicing NC III or equivalent in experience.*
- Must be physically and mentally fit to undergo training
- With good moral character

3.4 LIST OF TOOLS, EQUIPMENT AND MATERIALS

Recommended list of tools, equipment and materials for the training of 25 trainees for

Qty.	TOOLS Description	Qty.	EQUIPMENT Description	Qty.	MATERIAL Description
25 pcs	Long-nosed pliers	25 pcs	Multimeters	1 spool	Solder lead
25 pcs	Diagonal cutters	5 pcs	Signal simulators	1 spool	Shielded instrumentation cable
25 pcs	Standard screwdrivers	5 pcs	Multifunction Calibrators	1 lot	Terminal lugs
25 pcs	Phillips screwdrivers	5 pcs	Pressure transmitters	1 lot	Terminal strips/blocks
25 pcs	Electrical pliers	5 pcs	Pressure gages	25 pcs	Cotton gloves
25 pcs	Soldering iron	1 pc.	Air compressor	1 lot	Copper tubing
25 pcs	Adjustable wrench	5 pcs	Thermocouple sensors	1 lot	Plastic tubing
5 pcs	Wire stripper	5 pcs	RTD sensors	1 lot	Compression fittings
5 pcs	Crimping tool	5 pcs	Temperature transmitters, Universal input	25 rolls	Electrical tape
5 sets	Allen wrench	5 pcs	Loop power supplies	25 rolls	Teflon sealant tape
5 sets	Jeweller's screwdrivers	5 pcs	Instrument stanchions	1 lot	Cable ties
5 sets	Combination wrench, metric	5 pcs	Process indicators		
5 sets	Combination wrench, English	5 pcs	Process controllers		
		1 pc.	Control valve w/ positioner		
		1 pc.	I/P Converter		
		5 pcs	Desktop PC		
		2 pcs	Oscilloscope		
		5 sets	Communication equipment		

		1 pc.	Safety helmet		
		1 pc.	Safety shoes		
		1 pc.	Safety harness		
		1 pc.	Safety glasses/ goggles		
		1 pc.	Ear plugs/ear muffs		
		1 pc.	Gas mask		
		1 pc.	Face shield		

3.5   TRAINING FACILITIES

Based on class size of 25 students/trainees the space requirements for the teaching/learning and circulation areas are as follows:

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	5 x 8	40	1	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	1	2
Total				122
Facilities / Equipment / Circulation**				36
Total Area				158

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

3.6 TRAINERS QUALIFICATIONS

Instrumentation & Control Technician NC IV
Trainer's Qualification TQ IV

- Must be an Instrumentation & Control Engineer or Instrumentation & Control Technician NC IV or equivalent qualification
- Must have completed a Trainer's Training course or has been a technical trainer for at least 3 years.
- Must have at least 2-years relevant industry experience.
- Must be physically & mentally fit.

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.

SECTION 4. NATIONAL ASSESSMENT AND CERTIFICATION ARRANGEMENTS

4.1   To attain the National Qualification of **Instrumentation and Control Servicing NC IV**, the candidate must demonstrate competence in all the units listed in Section 1. Successful candidates shall be awarded a **National Certificate IV** signed by the TESDA Director General.

4.2   The qualification of **Instrumentation and Control Servicing NC IV** may be attained through:

        4.2.1.   Accumulation of Certificates of Competency (COCs) in all the following units of competencies:

4.2.1.1	Install Instrumentation and Control Devices
4.2.1.2	Calibrate Instrumentation and Control Devices
4.2.1.3	Configure Instrumentation and Control Devices
4.2.1.4	Loop Check Instrumentation and Control Devices
4.2.1.5	Maintain and Repair Instrumentation and Control Devices
4.2.1.6	Start-up and Commissioning Instrumentation and Control Systems
4.2.1.7	Diagnose and Troubleshoot Instrumentation and Control Systems

        Successful candidates shall be awarded a **Certificate of Competency (COC)** in each of the core units.

4.3   Accumulation and submission of all COCs acquired for the relevant units of competency comprising a qualification, an individual shall be issued the corresponding National Certificate.

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

4.5   The following are qualified to apply for assessment and certification:

        4.5.1.   Graduate of formal, non-formal, and informal including enterprise-based training programs.

        4.5.2.   Experienced workers (wage employed or self employed)

4.6   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 Qualification and Certification System (PTQCS)".

DEFINITION 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

25) **Actuator:** In a closed-loop control system, that part of the final control element that translates the control signal into action by the control device.

26) **ANSI:** American National Standards Institute.

27) **ASME:** American Society of Mechanical Engineers.

28) **Assembler:** A program that translates assembly language instructions into machine language instructions.

29) **Assembly Language:** A machine oriented language in which mnemonics are used to represent each machine language instruction. Each CPU has its own specific assembly language.

30) **Automation**: (1) The conversion to and implementation of procedures, processes, or equipment by automated means. (2) Industrial open- or closed-loop control systems in which the manual operation of controls is replaced by servo operation.

31) **Calibration:** The process of adjusting an instrument or compiling a deviation chart so that its reading can be correlated to the actual value being measured.

32) **Control system**: The deliberate guidance or manipulation of the elements in a system in order to achieve a prescribed value or performance of a system to complete a defined process.

33) **Conveyor:** A horizontal, inclined or vertical device for moving or transporting bulk materials, packages, or objects in a path predetermined by the design of the device and having points of loading and discharge fixed, or selective.

34) **DAS:** Also known as Data Acquisition System, DAQ is a system of one or more sensors, devices and communication links used to scan or collect and forward data to a central location for further processing, display, or archiving.

35) **DCS:** Distributed Control System (DCS) is a big Programmable Logic Controller (PLC) that is typically networked to other controllers, PLCs or field devices. It typically has a workstation to interface with the controller and can be very expensive due to built-in security and fail-over features.

36) **Ergonomics** --"The systematic application of knowledge about the psychological, physical, and social attributes of human beings in the design and use of all things which affect a person's working conditions: equipment and machinery, the work environment and layout, the job itself, training and the organization of work." (Humansystems Inc).

37) **HMI:** Human Machine Interface (HMI) is a software application (typically a Graphical User Interface or GUI) that present information to the operator about the state of a process, and to accept and implement the operators control instructions. It may also interpret the plant information and guide the interaction of the operator with the system. Also known as Man Machine Interface (MMI).

38) **PID control**: Proportional plus Integral plus Derivative control is used in processes where the controlled variable is affected by long downtimes.

39) **PLC (Programmable Logic Controller)** : A class of industrially hardened devices that provides hardware interface for input sensors and output actuators. PLCs can be programmed using relay ladder logic to control the outputs based on input conditions and / or algorithms contained in the memory of the PLC.

40) **Process automation**: Includes objectives of control and also those of enterprise management. This requires an integrated approach to plant operations and enables a variety of applications such as production scheduling, inventory control, performance monitoring, statistical process control, maintenance management and environmental audit.

41) **Process control**: Automatic monitoring and control of a process by an instrument or computer programmed to respond appropriately to feedback from the process.

42) **SCADA:** Supervisory Control and Data Acquisition (SCADA) is a common process control application that collects data from sensors on the shop floor or in remote locations and sends them to a central computer for management and control.

43) **Sensor:** A transducer whose input is a physical phenomenon and whose output is a quantitative measure of the phenomenon.

44) **Sequence control:** The control of a series of machine movements, with the completion of one movement initiating the next. The extent of movements is typically not specified by numerical input data.

45) **Software**: The entire set of programs, procedures, and related documentation associated with a computer.

46) **Static Calibration:** A calibration recording pressure versus output at fixed points at room temperature.

47) **Systems integration**: The ability of computers, instrumentation, and equipment to share data or applications with other components in the same or other functional areas.

48) **Transducer:** A device that converts signals from one physical form to another.

ANNEX A - 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 Team
Develop and practice negotiation 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				

CORE COMPETENCIES

Install Instrumentation and Control Devices	**Calibrate Instrumentation and Control Devices**	**Configure Instrumentation and Control Devices**	**Loop Check Instrumentation and Control Devices**	**Maintain and Repair Instrumentation & Control Devices**
Start-up Instrumentation and Control Systems	**Diagnose and Troubleshoot Instrumentation and Control Systems**	Install Mechatronic Devices	Calibrate and Configure Mechatronic Devices	Configure and Apply Mechatronic Software Programs
Maintain and Repair Mechatronic Systems	Commission Mechatronic Systems	Diagnose and Troubleshoot Mechatronic Systems	Service and Repair Audio Systems and Products	Service and Repair Video Systems and Products
Service and Repair Business Machines	Assemble and Disassemble Consumer Electronic Products	Maintain and Repair Electronically Controlled Domestic Appliances	Maintain and Repair Audio-Video Products and Systems	Maintain and Repair Cellular Phones
Commission Consumer Electronic Products and Systems	Develop Servicing Systems for Consumer Electronic Products	Train service technician	Manage Servicing Systems for Consumer Electronics Products and Systems	Train service technician supervisors

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