COMPETENCY STANDARDS

SCADA PROGRAMMING
LEVEL III

ELECTRICAL & ELECTRONICS SECTOR

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

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

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

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Section 1   SCADA PROGRAMMING LEVEL III

The Supervisory Control and Data Acquisition (SCADA) Programming Level III consists of competencies that must be possessed to enable a person to develop and maintain a SCADA application.

The units of competency comprising this qualification include the following:

Unit Code	BASIC COMPETENCIES
400311319	Lead workplace communication
400311320	Lead small teams
400311321	Apply critical thinking and problem-solving techniques in the workplace
400311322	Work in a diverse environment
400311323	Propose methods of applying learning and innovation in the organization
400311324	Use information systematically
400311325	Evaluate occupational safety and health work practices
400311326	Evaluate environmental work practices
400311327	Facilitate entrepreneurial skills for micro-small-medium enterprises (MSMEs)

Unit Code	COMMON COMPETENCIES
CS-ELC311205	Use hand tools
CS-ELC311201	Perform mensuration and calculation
CS-ELC311202	Prepare and interpret technical drawing
CS-ELC311204	Apply quality standards
CS-ELC311203	Perform computer operations
CS-ELC311206	Terminate and connect electrical wiring and electronic circuits
CS-ELC311209	Test electronic components

Unit Code	CORE COMPETENCIES
CS-ELC311301	Develop SCADA application
CS-ELC311302	Maintain SCADA application

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

- SCADA systems programmer

SECTION 2:   COMPETENCY STANDARDS

This section gives the details of the contents of the basic, common, and core units of competency required for SCADA Programming Level III.

BASIC COMPETENCIES

UNIT OF COMPETENCY : LEAD WORKPLACE COMMUNICATION

UNIT CODE : 400311319

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

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Communicate information about workplace processes	1.1 Relevant *communication method* is selected based on workplace procedures 1.2 Multiple operations involving several topics/areas are communicated following enterprise requirements 1.3 Questioning is applied to gain extra information 1.4 Relevant sources of information are identified in accordance with workplace/ client requirements 1.5 Information is selected and organized following enterprise procedures 1.6 Verbal and written reporting is undertaken when required 1.7 Communication and negotiation skills are applied and maintained in all relevant situations	1.1. Organization requirements for written and electronic communication methods 1.2. Effective verbal communication methods 1.3. Business writing 1.4. Workplace etiquette	1.1. Organizing information 1.2. Conveying intended meaning 1.3. Participating in a variety of workplace discussions 1.4. Complying with organization requirements for the use of written and electronic communication methods 1.5. Effective business writing 1.6. Effective clarifying and probing skills 1.7. Effective questioning techniques (clarifying and probing)
2. Lead workplace discussions	2.1 Response to workplace issues are sought following enterprise procedures 2.2 Response to workplace issues are provided immediately 2.3 Constructive contributions are made to ***workplace discussions*** on such issues as	2.1 Organization requirements for written and electronic communication methods 2.2 Effective verbal communication methods 2.3 Workplace etiquette	2.1 Organizing information 2.2 Conveying intended meaning 2.3 Participating in variety of workplace discussions 2.4 Complying with organization requirements for the use of written

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	production, quality and safety 2.4 Goals/objectives and action plans undertaken in the workplace are communicated promptly		and electronic communication methods 2.5 Effective clarifying and probing skills
3. Identify and communicate issues arising in the workplace	3.1 Issues and problems are identified as they arise 3.2 Information regarding problems and issues are organized coherently to ensure clear and effective communication 3.3 Dialogue is initiated with appropriate personnel 3.4 Communication problems and issues are raised as they arise 3.5 Identify barriers in communication to be addressed appropriately	3.1 Organization requirements for written and electronic communication methods 3.2 Effective verbal communication methods 3.3 Workplace etiquette 3.4 Communication problems and issues 3.5 Barriers in communication	3.1 Organizing information 3.2 Conveying intended meaning 3.3 Participating in a variety of workplace discussions 3.4 Complying with organization requirements for the use of written and electronic communication methods 3.5 Effective clarifying and probing skills 3.6 Identifying issues 3.7 Negotiation and communication skills

RANGE OF VARIABLES

VARIABLE	RANGE
1. Methods of communication	May include: 1.1. Non-verbal gestures 1.2. Verbal 1.3. Face-to-face 1.4. Two-way radio 1.5. Speaking to groups 1.6. Using telephone 1.7. Written 1.8. Internet
2. Workplace discussions	May include: 2.1. Coordination meetings 2.2. Toolbox discussion 2.3. Peer-to-peer discussion

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1. Dealt with a range of communication/information at one time 1.2. Demonstrated leadership skills in workplace communication 1.3. Made constructive contributions in workplace issues 1.4. Sought workplace issues effectively 1.5. Responded to workplace issues promptly 1.6. Presented information clearly and effectively written form 1.7. Used appropriate sources of information 1.8. Asked appropriate questions 1.9. Provided accurate information
2. Resource Implications	The following resources **MUST** be provided: 2.1. Variety of Information 2.2. Communication tools 2.3. Simulated workplace
3. Methods of Assessment	Competency in this unit must be assessed through 3.1. Case problem 3.2. Third-party report 3.3. Portfolio 3.4. Interview 3.5. Demonstration/Role-playing
4. Context for Assessment	4.1. Competency may be assessed in the workplace or in simulated workplace environment

UNIT OF COMPETENCY : **LEAD SMALL TEAMS**

UNIT CODE : **400311320**

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes to lead small teams including setting, maintaining and monitoring team and individual performance standards.

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Provide team leadership	1.1. ***Work requirements*** are identified and presented to team members based on company policies and procedures 1.2. Reasons for instructions and requirements are communicated to team members based on company policies and procedures 1.3. ***Team members' queries and concerns*** are recognized, discussed and dealt with based on company practices	1.1 Facilitation of Team work 1.2 Company policies and procedures relating to work performance 1.3 Performance standards and expectations 1.4 Monitoring individual's and team's performance vis a vis client's and group's expectations	1.1 Communication skills required for leading teams 1.2 Group facilitation skills 1.3 Negotiating skills 1.4 Setting performance expectation
2. Assign responsibilities	2.1. Responsibilities are allocated having regard to the skills, knowledge and aptitude required to undertake the assigned task based on company policies. 2.2. Duties are allocated having regard to individual preference, domestic and personal considerations, whenever possible	2.1 Work plan and procedures 2.2 Work requirements and targets 2.2 Individual and group expectations and assignments 2.3 Ways to improve group leadership and membership	2.1 Communication skills 2.2 Management skills 2.3 Negotiating skills 2.4 Evaluation skills 2.5 Identifying team member's strengths and rooms for improvement
3. Set performance expectations for team members	3.1 Performance expectations are established based on client needs 3.2 Performance expectations are based on individual team members knowledge, skills and aptitude 3.3 Performance expectations are discussed and disseminated to individual team members	3.1 One's roles and responsibilities in the team 3.2 Feedback giving and receiving 3.3 Performance expectation	3.1 Communication skills 3.2 Accurate empathy 3.3 Congruence 3.4 Unconditional positive regard 3.5 Handling of Feedback

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
4. Supervised team performance	4.1 Performance is *monitored* based on defined performance criteria and/or assignment instructions 4.2 Team members are provided with *feedback*, positive support and advice on strategies to overcome any deficiencies based on company practices 4.3 *Performance issues* which cannot be rectified or addressed within the team are referenced to appropriate personnel according to employer policy 4.4 Team members are kept informed of any changes in the priority allocated to assignments or tasks which might impact on client/customer needs and satisfaction 4.5 Team operations are monitored to ensure that employer/client needs and requirements are met 4.6 Follow-up communication is provided on all issues affecting the team 4.7 All relevant documentation is completed in accordance with company procedures	4.1 Performance Coaching 4.2 Performance management 4.3 Performance Issues	4.1 Communication skills required for leading teams 4.2 Coaching skill

RANGE OF VARIABLES

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

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1. Maintained or improved individuals and/or team performance given a variety of possible scenario 1.2. Assessed and monitored team and individual performance against set criteria 1.3. Represented concerns of a team and individual to next level of management or appropriate specialist and to negotiate on their behalf 1.4. Allocated duties and responsibilities, having regard to individual's knowledge, skills and aptitude and the needs of the tasks to be performed 1.5. Set and communicated performance expectations for a range of tasks and duties within the team and provided feedback to team members
2. Resource Implications	The following resources **MUST** be provided: 2.1. Access to relevant workplace or appropriately simulated environment where assessment can take place 2.2. Materials relevant to the proposed activity or task
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1. Written Examination 3.2. Oral Questioning 3.3. Portfolio
4. Context for Assessment	4.1. Competency may be assessed in actual workplace or at the designated TESDA Accredited Assessment Center

UNIT OF COMPETENCY: **APPLY CRITICAL THINKING AND PROBLEM SOLVING TECHNIQUES IN THE WORKPLACE**

UNIT CODE **: 400311321**

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

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Examine specific workplace challenges	1.1. Variances are examined from normal operating **parameters;** and product quality. 1.2. Extent, cause and nature of the specific problem are defined through observation, investigation and *analytical techniques*. 1.3. *Problems* are clearly stated and specified.	1.1. Competence includes a thorough knowledge and understanding of the process, normal operating parameters, and product quality to recognize non-standard situations. 1.2. Competence to include the ability to apply and explain, enough for the identification of fundamental causes of specific workplace challenges. 1.3. Relevant equipment and operational processes. 1.4. Enterprise goals, targets and measures. 1.5. Enterprise quality OHS and environmental requirement. 1.6. Enterprise information systems and data collation 1.7. Industry codes and standards.	1.1. Using range of analytical techniques (e.g., planning, attention, simultaneous and successive processing of information) in examining specific challenges in the workplace. 1.2. Identifying extent and causes of specific challenges in the workplace.
2. Analyze the causes of specific workplace challenges.	2.1. Possible causes of specific problems are identified based on experience and the use of problem solving tools / analytical techniques. 2.2. Possible cause statements are developed based on findings. 2.3. Fundamental causes are identified per results of investigation conducted.	2.1 Competence includes a thorough knowledge and understanding of the process, normal operating parameters, and product quality to recognize non-standard situations. 2.2 Competence to include the ability to apply and explain, sufficient for the identification of fundamental cause, determining the	2.1 Using range of analytical techniques (e.g., planning, attention, simultaneous and successive processing of information) in examining specific challenges in the workplace.

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
		corrective action and provision of recommendations. 2.3 Relevant equipment and operational processes. 2.4 Enterprise goals, targets and measures. 2.5 Enterprise quality OSH and environmental requirement. 2.6 Enterprise information systems and data collation. 2.7 Industry codes and standards.	2.2 Identifying extent and causes of specific challenges in the workplace. 2.3 Providing clear-cut findings on the nature of each identified workplace challenges.
3. Formulate resolutions to specific workplace challenges	3.1. All possible options are considered for resolution of the problem. 3.2. Strengths and weaknesses of possible options are considered. 3.3. Corrective actions are determined to resolve the problem and possible future causes. 3.4. **Action *plans*** are developed identifying measurable objectives, resource needs and timelines in accordance with safety and operating procedures	3.1. Competence to include the ability to apply and explain, sufficient for the identification of fundamental cause, determining the corrective action and provision of recommendations 3.2. Relevant equipment and operational processes 3.3. Enterprise goals, targets and measures 3.4. Enterprise quality OSH and environmental requirement 3.5. Principles of decision making strategies and techniques 3.6. Enterprise information systems and data collation 3.7. Industry codes and standards	3.1. Using range of analytical techniques (e.g., planning, attention, simultaneous and successive processing of information) in examining specific challenges in the workplace. 3.2. Identifying extent and causes of specific challenges in the workplace. 3.3. Providing clear-cut findings on the nature of each identified workplace challenges. 3.4. Devising, communicating, implementing and evaluating strategies and techniques in addressing specific workplace challenges.

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ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
4. Implement action plans and communicate results	4.1. Action plans are implemented and evaluated. 4.2. Results of plan implementation and recommendations are prepared. 4.3. Recommendations are presented to appropriate personnel. 4.4. Recommendations are followed-up, if required.	4.1 Competence to include the ability to apply and explain, sufficient for the identification of fundamental cause, determining the corrective action and provision of recommendations 4.2. Relevant equipment and operational processes 4.3 Enterprise goals, targets and measures 4.4 Enterprise quality, OSH and environmental requirement 4.5 Principles of decision making strategies and techniques 4.6 Enterprise information systems and data collation 4.7 Industry codes and standards	4.1 Using range of analytical techniques (e.g., planning, attention, simultaneous and successive processing of information) in examining specific challenges in the workplace. 4.2 Identifying extent and causes of specific challenges in the workplace. 4.3 Providing clear-cut findings on the nature of each identified workplace challenges. 4.4 Devising, communicating, implementing and evaluating strategies and techniques in addressing specific workplace challenges.

RANGE OF VARIABLES

VARIABLES	RANGE
1. Parameters	May include: 1.1 Processes 1.2 Procedures 1.3 Systems
2. Analytical techniques	May include: 2.1. Brainstorming 2.2. Intuitions/Logic 2.3. Cause and effect diagrams 2.4. Pareto analysis 2.5. SWOT analysis 2.6. Gant chart, Pert CPM and graphs 2.7. Scattergrams
3. Problem	May include: 3.1. Routine, non – routine and complex workplace and quality problems 3.2. Equipment selection, availability and failure 3.3. Teamwork and work allocation problem 3.4. Safety and emergency situations and incidents 3.5. Risk assessment and management
4. Action plans	May include: 4.1. Priority requirements 4.2. Measurable objectives 4.3. Resource requirements 4.4. Timelines 4.5. Co-ordination and feedback requirements 4.6. Safety requirements 4.7. Risk assessment 4.8. Environmental requirements

EVIDENCE GUIDE

1. Critical aspects of Competency	**Assessment requires evidence that the candidate:** 1.1. Examined specific workplace challenges. 1.2. Analyzed the causes of specific workplace challenges. 1.3. Formulated resolutions to specific workplace challenges. 1.4. Implemented action plans and communicated results on specific workplace challenges.
2. Resource Implications	2.1. 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 reason behind the observable action.
3. Methods of Assessment	**Competency in this unit may be assessed through:** 3.1. Observation 3.2. Case Formulation 3.3. Life Narrative Inquiry 3.4. Standardized test The unit will be assessed in a holistic manner as is practical and may be integrated with the assessment of other relevant units of competency. Assessment will occur over a range of situations, which will include disruptions to normal, smooth operation. Simulation may be required to allow for timely assessment of parts of this unit of competency. Simulation should be based on the actual workplace and will include walk through of the relevant competency components. These assessment activities should include a range of problems, including new, unusual and improbable situations that may have happened.
4. Context for Assessment	4.1. In all workplace, it may be appropriate to assess this unit concurrently with relevant teamwork or operation units.

UNIT OF COMPETENCY : WORK IN A DIVERSE ENVIRONMENT

UNIT CODE : 400311322

UNIT DESCRIPTOR : This unit covers the outcomes required to work effectively in a workplace characterized by diversity in terms of religions, beliefs, races, ethnicities and other differences.

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Develop an individual's cultural awareness and sensitivity	1.1. Individual differences with clients, customers and fellow workers are recognized and respected in accordance with enterprise policies and core values. 1.2. Differences are responded to in a sensitive and considerate manner 1.3. *Diversity* is accommodated using appropriate verbal and non-verbal communication.	1.1. Understanding cultural diversity in the workplace 1.2. Norms of behavior for interacting and dialogue with specific groups (e. g., Muslims and other non-Christians, non-Catholics, tribes/ethnic groups, foreigners) 1.3. Different methods of verbal and non-verbal communication in a multicultural setting	1.1. Applying cross-cultural communication skills (i.e. different business customs, beliefs, communication strategies) 1.2. Showing affective skills – establishing rapport and empathy, understanding, etc. 1.3. Demonstrating openness and flexibility in communication 1.4. Recognizing diverse groups in the workplace and community as defined by divergent culture, religion, traditions and practices
2. Work effectively in an environment that acknowledges and values cultural diversity	2.1 Knowledge, skills and experiences of others are recognized and documented in relation to team objectives. 2.2 Fellow workers are encouraged to utilize and share their specific qualities, skills or backgrounds with other team members and clients to enhance work outcomes. 2.3 Relations with customers and clients are maintained to show that diversity is valued by the business.	2.1 Value of diversity in the economy and society in terms of Workforce development 2.2 Importance of inclusiveness in a diverse environment 2.3 Shared vision and understanding of and commitment to team, departmental, and organizational goals and objectives	2.1 Demonstrating cross-cultural communication skills and active listening 2.2 Recognizing diverse groups in the workplace and community as defined by divergent culture, religion, traditions and practices 2.3 Demonstrating collaboration skills 2.4 Exhibiting customer service excellence

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
		2.4 Strategies for customer service excellence	
3. Identify common issues in a multicultural and diverse environment	3.1 ***Diversity-related conflicts*** within the workplace are effectively addressed and resolved. 3.2 Discriminatory behaviors towards customers/stakeholders are minimized and addressed accordingly. 3.3 Change management policies are in place within the organization.	3.1 Value, and leverage of cultural diversity 3.2 Inclusivity and conflict resolution 3.3 Workplace harassment 3.4 Change management and ways to overcome resistance to change 3.5 Advanced strategies for customer service excellence	3.1 Addressing diversity-related conflicts in the workplace 3.2 Eliminating discriminatory behavior towards customers and co-workers 3.3 Utilizing change management policies in the workplace

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RANGE OF VARIABLES

VARIABLE	RANGE
1. Diversity	This refers to diversity in both the workplace and the community and may include divergence in : 1.1 Religion 1.2 Ethnicity, race or nationality 1.3 Culture 1.4 Gender, age or personality 1.5 Educational background
2. Diversity-related conflicts	May include conflicts that result from: 2.1 Discriminatory behaviors 2.2 Differences of cultural practices 2.3 Differences of belief and value systems 2.4 Gender-based violence 2.5 Workplace bullying 2.6 Corporate jealousy 2.7 Language barriers 2.8 Individuals being differently-abled persons 2.9 Ageism (negative attitude and behavior towards old people)

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Adjusted language and behavior as required by interactions with diversity 1.2 Identified and respected individual differences in colleagues, clients and customers 1.3 Applied relevant regulations, standards and codes of practice
2. Resource Implications	The following resources should be provided: 2.1 Access to workplace and resources 2.2 Manuals and policies on Workplace Diversity
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Demonstration or simulation with oral questioning 3.2 Group discussions and interactive activities 3.3 Case studies/problems involving workplace diversity issues 3.4 Third-party report 3.5 Written examination 3.6 Role Plays
4. Context for Assessment	Competency assessment may occur in workplace or any appropriately simulated environment

UNIT OF COMPETENCY: **PROPOSE METHODS OF APPLYING LEARNING AND INNOVATION IN THE ORGANIZATION**

UNIT CODE : **400311323**

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes required to assess general obstacles in the application of learning and innovation in the organization and to propose practical methods of such in addressing organizational challenges.

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Assess work procedures, processes and systems in terms of innovative practices	1.1. R*easons* for innovation are incorporated to work procedures. 1.2. *Models of innovation* are researched. 1.3. G*aps or barriers* to innovation in one's work area are analyzed. 1.4. Staff who can support and foster innovation in the work procedure are identified.	1.1 Seven habits of highly effective people. 1.2 Character strengths that foster innovation and learning (Christopher Peterson and Martin Seligman, 2004) 1.3 Five minds of the future concepts (Gardner, 2007). 1.4 Adaptation concepts in neuroscience (Merzenich, 2013). 1.5 Transtheoretical model of behavior change (Prochaska, DiClemente, & Norcross, 1992).	1.1 Demonstrating collaboration and networking skills. 1.2 Applying basic research and evaluation skills 1.3 Generating insights on how to improve organizational procedures, processes and systems through innovation.
2. Generate practical action plans for improving work procedures, processes	2.1 Ideas for innovative work procedure to foster innovation using individual and group techniques are conceptualized 2.2 Range of ideas with other team members and colleagues are evaluated and discussed 2.3 Work procedures and processes subject to change are selected based on *workplace requirements* (feasible and innovative). 2.4 Practical action plans are proposed to facilitate simple changes in the work procedures, processes and systems. 2.5 *Critical inquiry* is applied and used to	2.1 Seven habits of highly effective people. 2.2 Character strengths that foster innovation and learning (Christopher Peterson and Martin Seligman, 2004) 2.3 Five minds of the future concepts (Gardner, 2007). 2.4 Adaptation concepts in neuroscience (Merzenich, 2013). 2.5 Transtheoretical model of behavior change (Prochaska, DiClemente, & Norcross, 1992).	2.1 Assessing readiness for change on simple work procedures, processes and systems. 2.2 Generating insights on how to improve organizational procedures, processes and systems through innovation. 2.3 Facilitating action plans on how to apply innovative procedures in the organization.

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	facilitate discourse on adjustments in the simple work procedures, processes and systems.		
3. Evaluate the effectiveness of the proposed action plans	3.1 Work structure is analyzed to identify the impact of the new work procedures 3.2 Co-workers/key personnel is consulted to know who will be involved with or affected by the work procedure 3.3 Work instruction operational plan of the new work procedure is developed and evaluated. 3.4 Feedback and suggestion are recorded. 3.5 Operational plan is updated. 3.6 Results and impact on the developed work instructions are reviewed 3.7 Results of the new work procedure are evaluated 3.8 Adjustments are recommended based on results gathered	3.1 Five minds of the future concepts (Gardner, 2007). 3.2 Adaptation concepts in neuroscience (Merzenich, 2013). 3.3 Transtheoretical model of behavior change (Prochaska, DiClemente, & Norcross, 1992).	3.1 Generating insights on how to improve organizational procedures, processes and systems through innovation. 3.2 Facilitating action plans on how to apply innovative procedures in the organization. 3.3 Communicating results of the evaluation of the proposed and implemented changes in the workplace procedures and systems. 3.4 Developing action plans for continuous improvement on the basic systems, processes and procedures in the organization.

RANGE OF VARIABLES

VARIABLE	RANGE
1. Reasons	May include: 1.1. Strengths and weaknesses of the current systems, processes and procedures. 1.2. Opportunities and threats of the current systems, processes and procedures.
2. Models of innovation	May include: 2.1. Seven habits of highly effective people. 2.2. Five minds of the future concepts (Gardner, 2007). 2.3. Neuroplasticity and adaptation strategies.
3. Workplace requirements	May include: 3.1. Feasible 3.2. Innovative
4. Gaps or barriers	May include: 4.1. Machine 4.2. Manpower 4.3. Methods 4.4. Money
5. Critical Inquiry	May include: 5.1. Preparation. 5.2. Discussion. 5.3. Clarification of goals. 5.4. Negotiate towards a Win-Win outcome. 5.5. Agreement. 5.6. Implementation of a course of action. 5.7. Effective verbal communication. See our pages: Verbal Communication and Effective Speaking. 5.8. Listening. 5.9. Reducing misunderstandings is a key part of effective negotiation. 5.10. Rapport Building. 5.11. Problem Solving. 5.12. Decision Making. 5.13. Assertiveness. 5.14. Dealing with Difficult Situations.

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate:
	1.1 Established the reasons why innovative systems are required
	1.2 Established the goals of a new innovative system
	1.3 Analyzed current organizational systems to identify gaps and barriers to innovation.
	1.4 Assessed work procedures, processes and systems in terms of innovative practices.
	1.5 Generated practical action plans for improving work procedures, and processes.
	1.6 Reviewed the trial innovative work system and adjusted reflect evaluation feedback, knowledge management systems and future planning.
	1.7 Evaluated the effectiveness of the proposed action plans.
2. Resource Implications	The following resources should be provided:
	2.1 Pens, papers and writing implements.
	2.2 Cartolina.
	2.3 Manila papers.
3. Methods of Assessment	Competency in this unit may be assessed through:
	3.1 Psychological and behavioral Interviews.
	3.2 Performance Evaluation.
	3.3 Life Narrative Inquiry.
	3.4 Review of portfolios of evidence and third-party workplace reports of on-the-job performance.
	3.5 Sensitivity analysis.
	3.6 Organizational analysis.
	3.7 Standardized assessment of character strengths and virtues applied.
4. Context for Assessment	4.1 Competency may be assessed individually in the actual workplace or simulation environment in TESDA accredited institutions.

UNIT OF COMPETENCY: USE INFORMATION SYSTEMATICALLY

UNIT CODE : **400311324**

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes required to use technical information systems, apply information technology (IT) systems and edit, format & check information.

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Use technical information	1.1. *Information* are collated and organized into a suitable form for reference and use 1.2. Stored information are classified so that it can be quickly identified and retrieved when needed 1.3. Guidance are advised and offered to people who need to find and use information	1.1. Application in collating information 1.2. Procedures for inputting, maintaining and archiving information 1.3. Guidance to people who need to find and use information 1.4. Organize information 1.5. classify stored information for identification and retrieval 1.6. Operate the technical information system by using agreed procedures	1.1. Collating information 1.2. Operating appropriate and valid procedures for inputting, maintaining and archiving information 1.3. Advising and offering guidance to people who need to find and use information 1.4. Organizing information into a suitable form for reference and use 1.5. Classifying stored information for identification and retrieval 1.6. Operating the technical information system by using agreed procedures
2. Apply information technology (IT)	2.1. *Technical information* system is operated using agreed procedures 2.2. Appropriate and valid procedures are operated for inputting, maintaining and archiving information 2.3. *Software* required are utilized to execute the project activities 2.4. Information and data obtained are handled, edited, formatted and checked from a range of	2.1. Attributes and limitations of available software tools 2.2. Procedures and work instructions for the use of IT 2.3. Operational requirements for IT systems 2.4. Sources and flow paths of data 2.5. Security systems and measures that can be used	2.1. Identifying attributes and limitations of available software tools 2.2. Using procedures and work instructions for the use of IT 2.3. Describing operational requirements for IT systems 2.4. Identifying sources and flow paths of data

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	internal and external *sources* 2.5. Information are extracted, entered, and processed to produce the outputs required by *customers* 2.6. Own skills and understanding are shared to help others 2.7. Specified *security measures* are implemented to protect the confidentiality and integrity of project data held in IT systems	2.6. Extract data and format reports 2.7. Methods of entering and processing information 2.8. WWW enabled applications	2.5. Determining security systems and measures that can be used 2.6. Extracting data and format reports 2.7. Describing methods of entering and processing information 2.8. Using WWW applications
3. Edit, format and check information	3.1 Basic editing techniques are used 3.2 Accuracy of documents are checked 3.3 Editing and formatting tools and techniques are used for more complex documents 3.4 Proof reading techniques is used to check that documents look professional	3.1 Basic file-handling techniques 3.2 Techniques in checking documents 3.3 Techniques in editing and formatting 3.4 Proof reading techniques	3.1 Using basic file-handling techniques is used for the software 3.2 Using different techniques in checking documents 3.3 Applying editing and formatting techniques 3.4 Applying proof reading techniques

RANGE OF VARIABLES

VARIABLE	RANGE
1. Information	May include: 1.1. Property 1.2. Organizational 1.3. Technical reference
2. Technical information	May include: 2.1. paper based 2.2. electronic
3. Software	May include: 3.1. spreadsheets 3.2. databases 3.3. word processing 3.4. presentation
4. Sources	May include: 4.1. other IT systems 4.2. manually created 4.3. within own organization 4.4. outside own organization 4.5. geographically remote
5. Customers	May include: 5.1. colleagues 5.2. company and project management 5.3. clients
6. Security measures	May include: 6.1. access rights to input; 6.2. passwords; 6.3. access rights to outputs; 6.4. data consistency and back-up; 6.5. recovery plans

EVIDENCE GUIDE

1.	Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1. Used technical information systems and information technology 1.2. Applied information technology (IT) systems 1.3. Edited, formatted and checked information
2.	Resource Implications	The following resources **MUST** be provided: 2.1. Computers 2.2. Software and IT system
3.	Methods of Assessment	Competency in this unit **MUST** be assessed through: 3.1. Direct Observation 3.2. Oral interview and written test
4.	Context for Assessment	4.1. Competency may be assessed individually in the actual workplace or through accredited institution

UNIT OF COMPETENCY : **EVALUATE OCCUPATIONAL SAFETY AND HEALTH WORK PRACTICES**

UNIT CODE : **400311325**

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes required to interpret Occupational Safety and Health practices, set OSH work targets, and evaluate effectiveness of Occupational Safety and Health work instructions

ELEMENT	PERFORMANCE CRITERIA *Italicized terms* are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Interpret Occupational Safety and Health practices	1.1 ***OSH work practices issues*** are identified relevant to work requirements 1.2 OSH work standards and procedures are determined based on applicability to nature of work 1.3 Gaps in work practices are identified related to relevant OSH work standards	1.1. OSH work practices issues 1.2. OSH work standards 1.3. General OSH principles and legislations 1.4. Company/ workplace policies/ guidelines 1.5. Standards and safety requirements of work process and procedures	1.1. Communication skills 1.2. Interpersonal skills 1.3. Critical thinking skills 1.4. Observation skills
2. Set OSH work targets	2.1 Relevant work information are gathered necessary to determine OSH work targets 2.2 ***OSH Indicators*** based on gathered information are agreed upon to measure effectiveness of workplace OSH policies and procedures 2.3 Agreed OSH indicators are endorsed for approval from appropriate personnel 2.4 ***OSH work instructions*** are received in accordance with workplace policies and procedures*	2.1. OSH work targets 2.2. OSH Indicators 2.3. OSH work instructions 2.4. Safety and health requirements of tasks 2.5. Workplace guidelines on providing feedback on OSH and security concerns 2.6. OSH regulations Hazard control procedures 2.7. OSH trainings relevant to work	2.1. Communication skills 2.2. Collaborating skills 2.3. Critical thinking skills 2.4. Observation skills
3. Evaluate effectiveness of Occupational Safety and Health work instructions	3.1 OSH Practices are observed based on workplace standards 3.2 Observed OSH practices are measured against approved ***OSH metrics*** 3.3 Findings regarding effectiveness are assessed and gaps identified are implemented based on OSH work standards	3.1. OSH Practices 3.2. OSH metrics 3.3. OSH Evaluation Techniques 3.4. OSH work standards	3.1. Critical thinking skills 3.2. Evaluating skills

RANGE OF VARIABLES

VARIABLE	RANGE
1. OSH Work Practices Issues	May include: 1.1 Workers' experience/observance on presence of work hazards 1.2 Unsafe/unhealthy administrative arrangements (prolonged work hours, no break-time, constant overtime, scheduling of tasks) 1.3 Reasons for compliance/non-compliance to use of PPEs or other OSH procedures/policies/ guidelines
2. OSH Indicators	May include: 2.1 Increased of incidents of accidents, injuries 2.2 Increased occurrence of sickness or health complaints/symptoms 2.3 Common complaints of workers' related to OSH 2.4 High absenteeism for work-related reasons
3. OSH Work Instructions	May include: 3.1 Preventive and control measures, and targets 3.2 Eliminate the hazard (i.e., get rid of the dangerous machine 3.3 Isolate the hazard (i.e. keep the machine in a closed room and operate it remotely; barricade an unsafe area off) 3.4 Substitute the hazard with a safer alternative (i.e., replace the machine with a safer one) 3.5 Use administrative controls to reduce the risk (i.e. give trainings on how to use equipment safely; OSH-related topics, issue warning signages, rotation/shifting work schedule) 3.6 Use engineering controls to reduce the risk (i.e. use safety guards to machine) 3.7 Use personal protective equipment 3.8 Safety, Health and Work Environment Evaluation 3.9 Periodic and/or special medical examinations of workers
4. OSH metrics	May include: 4.1 Statistics on incidence of accidence and injuries 4.2 Morbidity (Type and Number of Sickness) 4.3 Mortality (Cause and Number of Deaths) 4.4 Accident Rate

EVIDENCE GUIDE

1. Critical aspects of Competency	**Assessment requires evidence that the candidate:**
	1.1. Identify OSH work practices issues relevant to work requirements
	1.2. Identify gaps in work practices related to relevant OSH work standards
	1.3. Agree upon OSH Indicators based on gathered information to measure effectiveness of workplace OSH policies and procedures
	1.4. Receive OSH work instructions in accordance with workplace policies and procedures
	1.5. Compare Observed OSH practices with against approved OSH work instructions
	1.6. Assess findings regarding effectiveness based on OSH work standards
2. Resource Implications	**The following resources should be provided:**
	2.1 Facilities, materials, tools and equipment necessary for the activity
3. Methods of Assessment	**Competency in this unit may be assessed through:**
	3.1 Observation/Demonstration with oral questioning
	3.2 Third party report
	3.3 Written exam
4. Context for Assessment	4.1 Competency may be assessed in the work place or in a simulated work place setting

UNIT OF COMPETENCY : **EVALUATE ENVIRONMENTAL WORK PRACTICES**
UNIT CODE : **400311326**
UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitude to interpret environmental Issues, establish targets to evaluate environmental practices and evaluate effectiveness of environmental practices

ELEMENTS	PERFORMANCE CRITERIA *Italicized terms* are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Interpret environmental practices, policies and procedures	1.1 ***Environmental work practices*** issues are identified relevant to work requirements 1.2 Environmental Standards and Procedures nature of work are determined based on Applicability to nature of work 1.3 Gaps in work practices related to Environmental Standards and Procedures are identified	1.1 Environmental Issues 1.2 Environmental Work Procedures 1.3 Environmental Laws 1.4 Environmental Hazardous and Non-Hazardous Materials 1.5 Environmental required license, registration or certification	1.1. Analyzing Environmental Issues and Concerns 1.2. Critical thinking 1.3. Problem Solving 1.4. Observation Skills
2. Establish targets to evaluate environmental practices	2.1. Relevant information are gathered necessary to determine environmental work targets 2.2. ***Environmental Indicators*** based on gathered information are set to measure environmental work targets 2.3. Indicators are verified with appropriate personnel	2.1. Environmental Indicators 2.2. Relevant Environment Personnel or expert 2.3. Relevant Environmental Trainings and Seminars	2.1. Investigative Skills 2.2. Critical thinking 2.3. Problem Solving 2.4. Observation Skills
3. Evaluate effectiveness of environmental practices	3.1. Work environmental practices are recorded based on workplace standards 3.2. Recorded work environmental practices are compared against planned indicators 3.3. Findings regarding effectiveness are assessed and gaps identified are implemented based on environment work standards and procedures 3.4. Results of environmental assessment are conveyed to appropriate personnel	1.1. Environmental Practices 1.2. Environmental Standards and Procedures	3.1 Documentation and Record Keeping Skills 3.2 Critical thinking 3.3 Problem Solving 3.4 Observation Skills

RANGE OF VARIABLES

VARIABLE	R A N G E
1. Environmental Practices Issues	May include: 1.1 Water Quality 1.2 National and Local Government Issues 1.3 Safety 1.4 Endangered Species 1.5 Noise 1.6 Air Quality 1.7 Historic 1.8 Waste 1.9 Cultural
2. Environmental Indicators	May include: 2.1 Noise level 2.2 Lighting (Lumens) 2.3 Air Quality - Toxicity 2.4 Thermal Comfort 2.5 Vibration 2.6 Radiation 2.7 Quantity of the Resources 2.8 Volume

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1. Identified environmental issues relevant to work requirements 1.2. Identified gaps in work practices related to Environmental Standards and Procedures 1.3. Gathered relevant information necessary to determine environmental work targets 1.4. Set environmental indicators based on gathered information to measure environmental work targets 1.5. Recorded work environmental practices are recorded based on workplace standards 1.6. Conveyed results of environmental assessment to appropriate personnel
2. Resource Implications	The following resources should be provided: 2.1 Workplace/Assessment location 2.2 Legislation, policies, procedures, protocols and local ordinances relating to environmental protection 2.3 Case studies/scenarios relating to environmental protection
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Written/ Oral Examination 3.2 Interview/Third Party Reports 3.3 Portfolio (citations/awards from GOs and NGOs, certificate of training – local and abroad) 3.4 Simulations and role-plays
4. Context for Assessment	4.1 Competency may be assessed in actual workplace or at the designated TESDA center.

UNIT OF COMPETENCY : FACILITATE ENTREPRENEURIAL SKILLS FOR MICRO-SMALL-MEDIUM ENTERPRISES (MSMEs)

UNIT CODE   : 400311327

UNIT DESCRIPTOR   : This unit covers the outcomes required to build, operate and grow a micro/small-scale enterprise.

ELEMENT	PERFORMANCE CRITERIA *Italicized terms* are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Develop and maintain micro-small-medium enterprise (MSMEs) skills in the organization	1.1 Appropriate *business strategies* are determined and set for the enterprise based on current and emerging business environment. 1.2 *Business operations* are monitored and controlled following established procedures. 1.3 Quality assurance measures are implemented consistently. 1.4 Good relations are maintained with staff/workers. 1.5 Policies and procedures on occupational safety and health and environmental concerns are constantly observed.	1.1 Business models and strategies 1.2 Types and categories of businesses 1.3 Business operation 1.4 Basic Bookkeeping 1.5 Business internal controls 1.6 Basic quality control and assurance concepts 1.7 Government and regulatory processes	1.1 Basic bookkeeping/ accounting skills 1.2 Communication skills 1.3 Building relations with customer and employees 1.4 Building competitive advantage of the enterprise
2. Establish and Maintain client-base/market	2.1 Good customer relations are maintained 2.2 New customers and markets are identified, explored and reached out to. 2.3 Promotions/Incentives are offered to loyal customers 2.4 Additional products and services are evaluated and tried where feasible. 2.5 *Promotional/advertising initiatives* are carried out where necessary and feasible.	2.1 Public relations concepts 2.2 Basic product promotion strategies 2.3 Basic market and feasibility studies 2.4 Basic business ethics	2.1 Building customer relations 2.2 Individual marketing skills 2.3 Using basic advertising (posters/ tarpaulins, flyers, social media, etc.)
3. Apply budgeting and financial management skills	3.1 Enterprise is built up and sustained through judicious control of cash flows. 3.2 Profitability of enterprise is ensured though appropriate *internal controls*. 3.3 Unnecessary or lower-priority expenses and purchases are avoided.	3.1 Cash flow management 3.1 Basic financial management 3.2 Basic financial accounting 3.3 Business internal controls	3.1 Setting business priorities and strategies 3.2 Interpreting basic financial statements 3.3 Preparing business plans

RANGE OF VARIABLES

VARIABLE	RANGE
1. Business strategies	May include: 1.1. Developing/Maintaining niche market 1.2. Use of organic/healthy ingredients 1.3. Environment-friendly and sustainable practices 1.4. Offering both affordable and high-quality products and services 1.5. Promotion and marketing strategies (e. g., on-line marketing)
2. Business operations	May include: 2.1 Purchasing 2.2 Accounting/Administrative work 2.3 Production/Operations/Sales
3. Internal controls	May include: 3.1 Accounting systems 3.2 Financial statements/reports 3.3 Cash management
4. Promotional/ Advertising initiatives	May include: 4.1 Use of tarpaulins, brochures, and/or flyers 4.2 Sales, discounts and easy payment terms 4.3 Use of social media/Internet 4.4 "Service with a smile" 4.5 Extra attention to regular customers

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate : 1.1 Demonstrated basic entrepreneurial skills 1.2 Demonstrated ability to conceptualize and plan a micro/small enterprise 1.3 Demonstrated ability to manage/operate a micro/small-scale business
2. Resource Implications	The following resources should be provided: 2.1 Simulated or actual workplace 2.2 Tools, materials and supplies needed to demonstrate the required tasks 2.3 References and manuals
3. Methods of Assessment	Competency in this unit may be assessed through : 3.1 Written examination 3.2 Demonstration/observation with oral questioning 3.3 Portfolio assessment with interview 3.4 Case problems
4. Context of Assessment	1.1 Competency may be assessed in workplace or in a simulated workplace setting 1.2 Assessment shall be observed while tasks are being undertaken whether individually or in-group

COMMON COMPETENCIES

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

ELEMENT	PERFORMANCE CRITERIA *Italicized Bold* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Plan and prepare for tasks to be undertaken	1.1. Tasks to be undertaken are properly identified 1.2. Appropriate **hand tools** are identified and selected according to the task requirements	1.1. Planning and preparing task/ activity 1.2. Electronics hand tools and their uses 1.3. Function, operation and common faults in electronics hand tools	1.1. Preparing required tasks 1.2. Communication skills 1.3. Using hand tools properly
2. Prepare hand tools	2.1. Appropriate hand tools are checked for proper operation and safety 2.2. Unsafe or faulty tools are identified and marked for repair according to standard company procedure	2.1. Checking and safety requirements in handling tools 2.2. Standard procedures in checking, identification and marking of safe or unsafe/ faulty tools	2.1. Identifying and checking hand tools 2.2. Marking of safe or unsafe/ faulty hand tools

3. Use appropriate hand tools and test equipment	3.1. Tools are used according to tasks undertaken
	3.2. All safety procedures in using tools are observed at all times and appropriate **personal protective equipment** (PPE) are used
	3.3. Malfunctions, unplanned or unusual events are reported to the supervisor
		3.1. Safety requirements in using electronics hand tools and test equipment
		3.2. Electronics hand tools for adjusting, dismantling, assembling, finishing, and cutting.
		3.3. Processes, Operations, Systems
		   ○ Proper usage and care of hand tools
		   ○ Types and uses of test equipment
		3.4. Common faults in the use of hand tool
			3.1. Reading skills required to interpret work instruction and numerical skills
			3.2. Using PPE properly
			3.3. Problem solving in emergency situation

4. Maintain hand tools	4.1. Tools are handled without damage according to procedures.
	4.2. Routine **maintenance** of tools is 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
		4.1. Safety requirements in maintenance of hand tools
		4.2. Processes, Operations, Systems
		   ○ Maintenance of tools
		   ○ Storage of hand tools
			4.1. Checking and cleaning hand tools
			4.2. Storing hand tools properly

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. Method of assessment	Competency in this unit must be assessed through: 2.1. Observation 2.2. Oral questioning
3. Resource Implication	3.1. Tools may include the following but not limited to: 3.1.1. screw drivers 3.1.2. pliers 3.1.3. punches 3.1.4. wrenches, files
4. Context of Assessment	4.1. Assessment may be conducted in the workplace or in a simulated environment

UNIT TITLE : **PERFORM MENSURATION AND CALCULATION**

UNIT CODE : **CS-ELC311201**

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes and values needed identify, care, handle and use measuring instruments

ELEMENT	PERFORMANCE CRITERIA *Italicized Bold* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Select measuring instruments	1.1. Object or component to be measured is identified, classified and interpreted to the appropriate regular ***geometric shape*** 1.2. Measuring tools are selected in line with job requirements 1.3. Correct specifications are obtained from relevant source 1.4. Appropriate ***measuring instrument*** is selected to achieve required outcome 1.5. Alternative measuring tools are used without sacrificing cost and quality of work	1.1. Category of measuring instruments 1.2. Types and uses of measuring instruments 1.3. Shapes and Dimensions 1.4. Formulas for volume, areas, perimeters of plane and geometric figures	1.1. Identifying and selecting measuring instruments 1.2. Visualizing objects and shapes
2. Carry out measurements and calculation	2.1. Accurate ***measurements and calculations*** are obtained for job 2.2. Calculation needed to complete work tasks are performed using the four basic process of addition (+), subtraction (-), multiplication (x), and division (/) 2.3. Calculation involving fractions, percentages and mixed numbers are used to complete workplace tasks. 2.4. Numerical computation is self-checked and corrected for accuracy 2.5. Instruments are read to the limit of accuracy of the tool. 2.6. Systems of measurement identified and converted according to job requirements/ISO 2.7. Work pieces are measured according to job requirements	2.1. Calculation & measurement 2.2. Four fundamental operation 2.3. Linear measurement 2.4. Dimensions 2.5. Unit conversion 2.6. Ratio and proportion	2.1. Performing calculation by addition, subtraction, multiplication and division; 2.2. Interpreting formulas for volume, areas, perimeters of plane and geometric figures 2.3. Handling of measuring instruments

ELEMENT	PERFORMANCE CRITERIA *Italicized Bold* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
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.	3.1. Types of measuring instruments and their uses 3.2. Safe handling procedures in using measuring instruments 3.3. Four fundamental operation of mathematics 3.4. Formula for volume, area, perimeter and other geometric figures	3.1. Handling and maintaining measuring instruments

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RANGE OF VARIABLES

VARIABLE	RANGE	
1. Geometric Shape	Including but I not limited to: 1.1 Round 1.2 Square 1.3 Rectangular 1.4 Triangle 1.5 Sphere 1.6 Conical	
2. Measuring instruments	Including but not limited to: 2.1 Micrometer (In-out, depth) 2.2 Vernier caliper (out, inside) 2.3 Dial gauge with mag, std. 2.4 Straight edge 2.5 Thickness gauge 2.6 Torque gauge 2.7 Small hole gauge 2.8 Telescopic gauge	2.9 Try-square 2.10 Protractor 2.11 Combination gauge 2.12 Steel rule 2.13 Voltmeter 2.14 Ammeter 2.15 Mega-ohmmeter 2.16 KWH meter 2.17 Gauges 2.18 Thermometers
3. Measurements and calculations	3.1 Linear 3.2 Volume 3.3 Area 3.4 Wattage 3.5 Voltage 3.6 Resistance 3.7 Amperage 3.8 Frequency 3.9 Impedance 3.10 Conductance 3.11 Capacitance	3.12 Displacement 3.13 Inside diameter 3.14 Circumference 3.15 Length 3.16 Thickness 3.17 Outside diameter 3.18 Taper 3.19 Out of roundness 3.20 Oil clearance 3.21 End play/thrust clearance

EVIDENCE GUIDE

1. Critical aspect of competency	Assessment must show 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. Resource implication	2.1. Place of assessment 2.2. Measuring instruments 2.3. Straight edge 2.4. Torque gauge 2.5. Try square 2.6. Protractor 2.7. Combination gauge 2.8. Steel rule
3. Method of assessment	Competency should be assessed through: 3.1 Actual demonstration 3.2 Direct observation 3.3 Written test/questioning related to required knowledge
4. Context of Assessment	Assessment may be conducted in the workplace or in a simulated environment

UNIT TITLE : **PREPARE AND INTERPRET TECHNICAL DRAWING**
UNIT CODE : **CS-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* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Identify different kinds of technical drawings	1.1. Correct *technical drawing* is selected according to job requirements. 1.2. Technical drawings are segregated in accordance with the types and kinds of drawings	1.1. Types of technical drawings 1.2. Applications for technical drawing 1.3. Methods of technical drawings 1.4. Symbols 1.5. Mark up/Notation of Drawings	1.1. Reading skills required to interpret work instruction 1.2. Interpreting electrical/ electronic signs and symbols

2. Interpret technical drawing	2.1. Components, assemblies or objects are recognized as required.
	2.2. *Dimensions* of the key features of the objects depicted in the drawing are correctly identified.
	2.3. *Symbols* used in the drawing are identified and interpreted correctly.
	2.4. Drawing is checked and validated against job requirements or equipment in accordance with standard operating procedures.
		2.1. Trade Mathematics
		  o Linear measurement
		  o Dimension
		  o Unit conversion
		2.2. Blueprint Reading and Plan Specification
		  o Architectural, electrical, electronics, mechanical plan, symbols and abbreviations
		  o Drawing standard symbols
		2.3. Trade Theory
		  o Basic technical drawing
		  o Types technical plans
		  o Various types of drawings
		  o Notes and specifications
			2.1. Interpreting drawing/ orthographic drawing
			2.2. Interpreting technical plans
			2.3. Matching specification details with existing resources
			2.4. Safety handling of drawing instruments

3. Prepare/make changes to electrical/ electronic schematics and drawings	3.1. Electrical/electronic schematic is drawn and correctly identified.
	3.2. Correct drawing is identified, equipment are selected and used in accordance with job requirements.
		3.1. Drawing conventions
		3.2. Dimensioning Conventions
		3.3. Mathematics
		  o Four fundamental operations
		  o Percentage
		  o Fraction
		  o Algebra
		  o Geometry
			3.1. Reading skills required to interpret work instruction
			3.2. Communication skills
			3.3. Preparing/ Making electrical/ electronic signs and symbols
			3.4. Computing formulas

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

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

RANGE OF VARIABLES

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

EVIDENCE GUIDE

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

UNIT TITLE : APPLY QUALITY STANDARDS

UNIT CODE : CS-ELC311204

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

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

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

RANGE OF VARIABLES

VARIABLE	RANGE

1. Materials/components	1.1. Materials may include but not limited to:
	    1.1.1. wires
	    1.1.2. cables, soldering lead
	    1.1.3. electrical tape
	1.2. Components may include but not limited to:
	    1.2.1. ICs
	    1.2.2. Diodes

2. Faults	Faults may include but not limited to: 2.1. Components/materials not according to specification 2.2. Components/materials contain manufacturing defects 2.3. Components/materials do not conform with government regulation i.e., PEC, environmental code 2.4. Components/materials have safety defect
3. Documentation	3.1. Organization work procedures 3.2. Manufacturer's instruction manual 3.3. Customer requirements 3.4. Forms

4. Quality standards	4.1. Quality standards may relate but not limited to the following:
	    4.1.1. materials
	    4.1.2. component parts
	    4.1.3. final product
	    4.1.4. production processes

5. Customer	5.1. Co-worker 5.2. Supplier 5.3. Client 5.4. Organization receiving the product or service

EVIDENCE GUIDE

1. Critical aspect of competency	Assessment 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. Method of assessment	Competency in this unit must be assessed through:
	3.1 Observation
	3.2 Oral Questioning
	3.3 Practical demonstration
3. Resource implication	3.1. Materials and component parts and equipment to be used in a real or simulated electronic production situation
4. Context of Assessment	4.1. Assessment may be conducted in the workplace or in a simulated work environment.

UNIT TITLE : **PERFORM COMPUTER OPERATIONS**
UNIT CODE : **CS-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	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Plan and prepare for task to be undertaken	1.1. Requirements of task are determined according to job specifications 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 1.4. Client -specific guidelines and procedures are followed. 1.5. Required data security guidelines are applied in accordance with existing procedures.	1.1. Main types of computers and basic features of different operating systems 1.2. Main parts of a computer 1.3. Information on hardware and software 1.4. Data security guidelines	1.1. Reading and comprehension skills required to interpret work instruction and to interpret basic user manuals. 1.2. Communication skills to identify lines of communication, request advice, follow instructions and receive feedback. 1.3. Interpreting user manuals and security guidelines
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*	2.1. Basic ergonomics of keyboard and computer user 2.2. Storage devices and basic categories of memory 2.3. Relevant types of software	2.1. Technology skills to use equipment safely including keyboard skills. 2.2. Entering data
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	3.1. General security, privacy legislation and copyright 3.2. Productivity Application 3.3. Business Application	3.1. Accessing information 3.2. Searching and browsing files and data

ELEMENT	PERFORMANCE CRITERIA *Italicized Bold* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	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	4.1. Computer application in printing, scanning and sending facsimile 4.2. Types and function of computer peripheral devices	4.1. Computer data processing 4.2. Printing of data 4.3. Transferring files and data
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	5.1. Computer equipment/ system basic maintenance procedures 5.2. Viruses 5.3. OH & S principles and responsibilities 5.4. Calculating computer capacity 5.5. System Software 5.6. Basic file maintenance procedures	5.1. Removing computer viruses from infected machines 5.2. Making backup files

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 includes 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. Planned and prepared for task to be undertaken 1.2. Inputted data into computer 1.3. Accessed information using computer 1.4. Produced/outputted data using computer system 1.5. Maintained computer equipment and systems
2. Method of assessment	Competency in this unit must be assessed through: 2.1. Observation 2.2. Questioning 2.3. Practical demonstration
3. Resource implication	3.1. Computer hardware with peripherals 3.2. Appropriate software
4. Context of Assessment	4.1. Assessment may be conducted in the workplace or in a simulated environment

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

UNIT CODE : **CS-ELC311206**

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

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Plan and prepare for termination/ connection of electrical wiring/ electronics circuits	1.1. *Materials* are checked according to specifications and tasks 1.2. Appropriate *tools and equipment* are selected according to tasks requirements 1.3. Task is planned to ensure OH & S guidelines and procedures are followed 1.4. Electrical wiring/electronic circuits are correctly prepared for connecting/ termination in accordance with instructions and work site procedures	1.1. Use of tools 1.2. Use of test instruments/ equipment 1.3. Electrical theory 1.4. Principals of AC and DC 1.5. OH & S guidelines and procedures 1.6. Basic electrical and electronic devices	1.1. Reading skills required to interpret work instruction 1.2. Checking materials for conformance to specifications 1.3. Checking existing and new installation site for correct location and specification
2. Terminate/ connect electrical wiring/ electronic circuits	2.1. Safety procedures in using tools are observed at all times and appropriate *personal protective equipment* are used 2.2. Work is undertaken safely in accordance with the workplace and standard procedures 2.3. Appropriate range of *methods* in termination/ connection are used according to specifications, manufacturer's requirements and safety 2.4. Correct sequence of operation is followed according to job specifications 2.5. *Accessories* used are adjusted, if necessary 2.6. Confirm termination/ connection undertaken successfully in accordance with job specification	2.1. Wiring techniques 2.2. OH & S principles 2.3. Use of lead-free soldering technology 2.4. Surface mount soldering techniques 2.5. Specifications and methods for terminating different materials	2.1. Communication skills 2.2. Marking, tagging and labeling requirements for cables, wires, conductors and connections 2.3. Soldering techniques 2.4. Adjusting and fixing wiring supports

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
3. Test termination/ connections of electrical wiring/ electronics circuits	3.1. Testing of all completed termination/ connections of electric wiring/electronic circuits is conducted for compliance with specifications and regulations using appropriate procedures and equipment 3.2. Wiring and circuits are checked using specified testing procedures 3.3. Unplanned events or conditions are responded to in accordance with established procedures	3.1. AC and DC power supplies 3.2. Use of diagnostic equipment 3.3. Surface mount soldering techniques 3.4. Tests for wiring and connections 3.5. Wiring support techniques and alternatives	3.1. Soldering techniques 3.2. Printed circuit board repair and techniques 3.3. Electronic assembly functional and quality testing 3.4. Undertaking testing of wiring and connections for conformance to specification 3.5. Using language and literacy skills to complete short reports and required 3.6. Adjusting and fixing wiring supports

RANGE OF VARIABLES

VARIABLE	RANGE

1. Materials	1.1 Materials included the following but not limited to:
	    1.1.1 Soldering lead
	    1.1.2 Cables
	    1.1.3 Wires

2. Tools and equipment	2.1 Tools for measuring, cutting, drilling, assembling/disassembling. Tool set includes the following but not limited to:
	    2.1.1 Pliers
	    2.1.2 Cutters
	    2.1.3 Screw drivers
	2.2 Equipment
	    2.2.1 Soldering gun
	    2.2.2 Multi-tester

3. Personal protective equipment	3.1 goggles 3.2 gloves 3.3 apron/overall
4. Methods	4.1 Clamping 4.2 Pin connection 4.3 Soldered joints 4.4 Plugs

5. Accessories	5.1 Accessories may include the following but not limited to:
	    5.1.1 brackets
	    5.1.2 clamps

EVIDENCE GUIDE

1. Critical aspect of competency	Assessment requires evidence that the candidate:
	1.1. Undertook work safely and according to workplace and standard procedures
	1.2. Used appropriate termination/ connection methods
	1.3. Followed correct sequence in termination / connection process
	1.4. Conducted testing of terminated connected electrical wiring/electronic circuits using appropriate procedures and standards
2. Method of assessment	Competency in this unit must be assessed through:
	2.1. Observation
	2.2. Oral Questioning
	2.3. Practical demonstration
3. Resource implication	Tools for measuring, cutting, drilling, assembling/ disassembling, connection. Tool set includes the following but not limited to:
	3.1 screw drivers
	3.2 pliers
	3.3 cutters
4. Context of Assessment	4.1. Assessment may be conducted in the workplace or in a simulated environment

UNIT OF COMPETENCY: **TEST ELECTRONIC COMPONENTS**

UNIT CODE **: CS-ELC311209**

DESCRIPTON : This unit covers the knowledge, skills and attitudes required to test electronic components. It includes competencies in determining the criteria for testing electronics components, planning an approach for component testing, testing the components and evaluating the testing process.

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Determine criteria for testing electronics components	1.1 Work instructions are obtained and clarified based on job order or client requirements 1.2 **Responsible person** is consulted for effective and proper work coordination 1.3 Data sheets/Application notes are obtained and interpreted based on manufacturer's specifications 1.4 **Testing criteria** are defined to ensure that components meet technical and quality requirements 1.5 Document and communicate testing criteria to relevant personnel	1.1 Mensuration/ Mathematics o Conversion of Units o Applied Mathematics 1.2 Safety o Work Safety requirements and economy of materials with durability 1.3 Systems and Processes o Principles of electrical / electronic circuits o Identifying sources of electricity o Identifying conductors and insulators o Supplying different voltage using variable power supply o Measuring resistance using VOM o Testing resistors o Measuring current and voltage using VOM 1.4 Testing Criteria o Controls o Effectiveness o Efficiency o Bug detection o Functionality, including flow o Interoperability o Performance o Reliability o Operating parameters	1.1 Work efficiently & systematically 1.2 Communication skills 1.3 Use and maintenance of tools and equipment 1.4 Skills in testing electronic components 1.5 Work safety practices and time management 1.6 Problem solving skills 1.7 Reading skills
2. Plan an approach for component testing	2.1 Various **testing methods** are Identified based on **types of electronic components** 2.2 Characteristics and appropriateness of testing methods to be used during	2.1 Safety o Work Safety requirements and economy of materials with durability o Knowledge in 5S application and	2.1 Skills in testing electronic components 2.2 Work safety practices and time management 2.3 Planning skills

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

	development and on completion is determined
	2.3 Testing methods are considered/selected in relation to appropriate ***testing strategy***
	2.4 Plan for testing components is developed at specified points during development and on completion
	2.5 Required ***test & measuring instruments*** and ***tools*** are prepared and checked in accordance with established procedures
	2.6 ***Records system*** is established to document testing results, including problems and faults
		observation of required timeframe
		2.2 Materials, tools and equipment uses and specifications
		  o Proper care and use of tools
		2.3 Types of electronic components
		  o Passive components
		  o Active components
		  o Dynamic components
		  o Hybrid components
		2.4 Testing methods
		  o Automated
		  o Debugging
		  o Inspection
		  o Platform testing
		  o Prototyping
		2.5 Systems and Processes
		  o Describing resistance and identify resistors
		  o Describing alternating current circuits
		  o Describing capacitance and identifying capacitors
		  o Describing inductance and identifying inductors
		  o Describing the characteristic of transformers
		  o Describing and identifying semiconductor diode
		  o Describing and identifying bipolar transistor
		  o Describing and analyzing digital gate
			2.4 Problem solving skills
			2.5 Reading skills
			2.6 Checking test & measuring instruments and tools
			2.7 Documentation skills

3. Test components	3.1 Testing methods are applied to ensure that products meet creative, production and technical requirements
	3.2 Problems and faults detected by testing are recorded and remedial steps taken in records system is documented
	3.3 Problems and faults detected during testing are resolved in accordance
		3.1 Safety
		  o Work Safety requirements and economy of materials with durability
		3.2 Materials, tools and equipment uses and specifications
		  o Proper care and use of tools
		3.3 Systems and Processes
		  o Principles of electrical/ electronic circuits
			3.1 Skills in testing electronic components
			3.2 Troubleshooting skills
			3.3 Problem solving skills
			3.4 Documentation skills
			3.5 Work efficiently & systematically

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	with agreed project or industry practice 3.4 Evaluate final products against the previously determined criteria 3.5 Testing process is documented and summarized evaluation report is submitted to relevant personnel	o Supplying different voltage using variable power supply o Measuring resistance using VOM o Testing resistors o Measuring current and voltage using VOM o Observing waveform using oscilloscope o Generating waveform in various frequency using function generator o Measuring frequency using oscilloscope o Measuring capacitance using VOM o Testing capacitors o Testing inductors o Testing semiconductor diode o Testing bipolar transistor o Testing logic gates	3.6 Product analysis and evaluation skills 3.7 Communication skills 3.8 Reading skills
4. Evaluate the testing process	4.1 Testing methods that were successful and those that led to difficulties are identified based on industry standards 4.2 Testing process and records system are evaluated based on standard procedures 4.3 Test results/findings are documented for subsequent components testing.	4.1 Evaluation of testing process and records system 4.2 Systems and Processes o Analyzing simple circuit using ohms and power law o Analyzing series/parallel circuits using ohms and power law o Analyzing series/parallel capacitances o Analyzing series parallel inductors o Analyzing rectifier circuits o Analyzing amplifier circuit o Analyzing multi-vibrator circuit o Analyzing logic networks o Analyzing sequence circuits	4.1 Work efficiently & systematically 4.2 Skills in testing electronic components 4.3 Product analysis and evaluation skills 4.4 Documentation skills 4.5 Communication skills 4.6 Reading skills

RANGE OF VARIABLES

VARIABLE	RANGE
1. Responsible person	Relevant personnel may include: 1.1. Immediate supervisor 1.2. Manager
2. Testing criteria	Testing criteria may include: 2.1. controls 2.2. effectiveness 2.3. efficiency 2.4. bug detection 2.5. functionality, including flow 2.6. interoperability 2.7. performance 2.8. reliability 2.9. operating parameters
3. Testing methods	Testing methods may include: 3.1. automated 3.2. debugging 3.3. inspection 3.4. platform testing 3.5. prototyping
4. Types of electronic components	4.1. Passive components 4.2. Active components 4.3. Dynamic components 4.4. Hybrid components
5. Testing strategy	Testing strategy may be determined by: 5.1. Passive testing 5.2. Dynamic testing 5.3. In-circuit testing
6. Test and measuring instruments	Test and measuring instruments may include: 6.1. Variable DC power supply 6.2. Digital VOM 6.3. analog VOM 6.4. dual trace triggered oscilloscope 6.5. function generator
7. Tools	Tools may include: 7.1. set of pliers 7.2. set of screw drivers 7.3. set of wrenches 7.4. Hand drills, 7.5. Hack saw 7.6. set of files 7.7. tin snip 7.8. Hammer

VARIABLE	RANGE
8. Records system	Records system may include:
	8.1. metadata that includes:
	8.1.1. description of fault
	8.1.2. identification of code
	8.1.3. user responses
	8.1.4. written or verbal comments
	8.1.5. quantitative data
	8.1.6. remedial action taken
	8.1.7. retest result
	8.1.8. date
	8.1.9. tester's details
	8.2. questionnaire
	8.3. survey

EVIDENCE GUIDE

1 Critical aspects of competency	Assessment requires evidence that the candidate:
	1.1 Determined criteria for testing electronics components
	1.2 Planned an approach for component testing
	1.3 Tested components
	1.4 Evaluated the testing process
2 Method of assessment	Competency may be assessed through two or more of the following methods:
	2.1 Direct observation of application to tasks and questions related to required knowledge
	2.2 Demonstration with oral questioning
	2.3 Third party report
	2.4 Written test
	2.5 Portfolio
3 Resource implications	The following resources must be provided:
	3.1 Tools and equipment (see range of variables)
	3.2 Working area/bench
	3.3 Electronic components
	3.4 Testing instruments and equipment
	3.5 Assessment rating sheet
	3.6 Reporting forms
4 Context of assessment	4.1 Assessment maybe conducted in the workplace or in a simulated workplace setting

CORE COMPETENCIES

UNIT TITLE : **DEVELOP SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA) APPLICATION**

UNIT CODE : **CS-ICT311301**

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitude required to develop SCADA application. This includes competencies in identifying, developing and entering programs using dedicated SCADA software. It also includes monitoring, verifying and documenting programming activities.

ELEMENT	PERFORMANCE CRITERIA *Italicized terms* are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Identify and determine SCADA controls requirements	1.1. **Key components** of SCADA software are discussed consistent with specifications 1.2. List for **system requirements** and licensing is prepared in line with work requirements	1.1. Course Introduction 1.2. Key components of SCADA 1.3. SCADA System Requirements and Licensing	1.1. Computer operation skills 1.2. Communication skills 1.3. Interpreting work instructions 1.4. Data verification skills
2. Develop software programs for process monitoring and controls	2.1. Procedure on how to lay out windows is discussed consistent with established standards. 2.2. Graphic and configured settings are embedded according to **specifications** 2.3. Show Window animation is added to an embedded graphic according to procedures 2.4. Create and configure **tags** are demonstrated according to procedures 2.5. Detailed displays is created consistent with P&ID and workflow or procedural displays 2.6. Data with displays built is visualized using the Situational Awareness Library	2.1. Window Layout and Basic Navigation 2.2. Embedding graphics and configure settings 2.3. Creation and Configuration of Tags 2.4. Situational Awareness Visualization Library	2.1. Computer skills 2.2. Communication skills 2.3. Interpreting work instructions 2.4. Data monitoring skills 2.5. Internet browsing
3. Present and manage live and historical alarms	3.1. Alarm subsystem and alarm types are described and defined according to specifications 3.2. How **alarms** can be visualized is explained	3.1. SCADA Alarms 3.2. Data Logging and Trending 3.3. Introduction to SCADA programming language	3.1. Computer skills 3.2. Communication skills 3.3. Interpreting work instructions

ELEMENT	PERFORMANCE CRITERIA *Italicized terms* are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	consistent with system specifications 3.3. Differences between real-time and historical trends is explained consistent with established principles 3.4. Trends is used to retrieve data from Historian according to procedures	3.4. Introduction to SCADA application symbols	3.4. Basic troubleshooting skills 3.5. Interpersonal skills 3.6. Data analysis skills
4. Create scripts to open SCADA application and navigate Windows	4.1. SCADA scripting is described consistent with established theories and principles 4.2. Application and window scripts are created according to specifications	4.1. Introduction to SCADA programming language 4.2. Introduction to Windows scripts	4.1. Computer skills 4.2. Communication skills 4.3. Interpreting work instructions 4.4. Basic troubleshooting skills 4.5. Data analysis skills 4.6. Creating scripts

RANGE OF VARIABLES

VARIABLE	RANGE
1 Key Components	May include but not limited to: 1.1 Create SCADA application 1.2 Build HMI with Situational Awareness symbols 1.3 Construct key performance indicator display 1.4 Configure an IO server 1.5 Establish communications with IO-aware programs 1.6 Create, export and import tags 1.7 Test and monitor tags 1.8 Build displays with pre-built library graphics 1.9 Build display with custom graphics 1.10 Visualize and interact with data 1.11 Present and manage live and historical alarms 1.12 Configure and apply security to an application 1.13 Log and trend historical data 1.14 Display real-time trend data 1.15 Backup and restore an application 1.16 Distribute an application to a production environment 1.17 View application windows and graphics in a browser
2 System Requirements	May include: 2.1 Hardware specifications and requirements 2.2 Communication protocols
3 Specifications	May include: 3.1 For view only 3.2 For read/write 3.3 For read/write with verification/security
4 Tags	May include: 4.1 Memory tags 4.2 I/O tags 4.3 System tags
5 Alarms	May include: 5.1 Critical 5.2 Major 5.3 Minor 5.4 Informational

EVIDENCE GUIDE

1. Critical Aspect of Competency	Assessment requires evidence that the candidate:
	
	1.1. Identified and determined SCADA controls requirements
	    1.1.1. Discussed key components of SCADA software consistent with specifications
	    1.1.2. Prepared list for system requirements and licensing in line with work requirements
	1.2. Developed software programs for process monitoring and controls
	    1.2.1. Embedded graphic and configured settings according to specifications
	    1.2.2. Added Show Window animation to an embedded graphic according to procedures
	    1.2.3. Demonstrated 'Create and configure tags' according to procedures
	    1.2.4. Created detailed displays consistent with P&ID and workflow or procedural displays
	    1.2.5. Visualized data with displays built using the Situational Awareness Library
	1.3. Presented and managed live and historical alarms
	    1.3.1. Described and defined alarm subsystem and alarm types according to specifications
	    1.3.2. Explained how alarms can be visualized consistent with system specifications
	    1.3.3. Explained differences between real-time and historical trends consistent with established principles
	    1.3.4. Used trends to retrieve data from historian according to procedures
	1.4. Created scripts to open SCADA application and navigated Windows
	    1.4.1. Created application and window scripts according to specifications

2. Resource Implication	The following resources should be provided: 2.1. Appropriate supplies and materials 2.2. Applicable equipment 2.3. Appropriate software 2.4. Workplace or assessment area
3. Method of Assessment	Competency in this unit may be assessed through: 3.1. Demonstration with oral questioning 3.2. Written Exam 3.3. Portfolio with interview
4. Context of Assessment	4.1. Competency may be assessed in the actual workplace or at the designated TESDA Accredited Assessment Center.

UNIT TITLE **:** **MAINTAIN SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA) APPLICATION**

UNIT CODE **:** **CS-ICT311302**

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitude required to maintain SCADA application. This includes competencies in configuring and applying security to an application, managing application symbols and backing-up and restoring an application.

ELEMENT	PERFORMANCE CRITERIA *Italicized terms* are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Configure and apply security to an application	1.1. Security application procedures are interpreted according to application requirements 1.2. Security is applied to an application according to established procedures 1.3. Application lock down is executed according to procedures	1.1. Security 1.1.1. procedures of applying security 1.1.2. procedures of executing lockdown	1.1. Computer operation skills 1.2. Communication skills 1.3. Interpreting work instructions 1.4. Using web browsers
2. Manage application symbols	2.1. Application symbols are ***managed***, if accidentally deleted according to procedures 2.2. ***Application maintenance*** considerations are described consistent with specifications	2.1. Managing application symbols 2.2. Application Maintenance	2.1. Computer operation skills 2.2. Communication skills 2.3. Interpreting work instructions 2.4. Using web browsers 2.5. Basic networking and internet connection troubleshooting
3. Back-up and restore an application	3.1. Back up SCADA application is performed according to established procedures 3.2. SCADA application is restored according to procedures 3.3. Restored application is inspected and tested according to established procedures	3.1. Backup and Restoring SCADA application 3.2. Inspection and testing of Application	3.1. Computer operation skills 3.2. Communication skills 3.3. Interpreting work instructions 3.4. Using web browsers 3.5. Basic networking and internet connection troubleshooting 3.6. Back up and restoring application skills

RANGE OF VARIABLES

VARIABLE	RANGE
1. Manage	May include: 1.1. Exporting 1.2. Importing 1.3. Restoring library symbols
2. Application maintenance	May include: 2.1. Managing application graphics 2.2. Backing-up SCADA application 2.3. Restoring SCADA application

EVIDENCE GUIDE

1. Critical Aspect of Competency	Assessment requires evidence that the candidate:
	1.1. Configure and apply security to an application
	    1.1.1. Security is applied to an application according to established procedures
	    1.1.2. Application lock down is executed according to procedures
	1.2. Manage application symbols
	    1.2.1. Application symbols, managed including exporting, importing, and restoring library symbols if accidentally deleted according to procedures
	1.3. Back-up and restore an application
	    1.3.1. Back up SCADA application is performed according to established procedures
	    1.3.2. SCADA application is restored according to procedures
	    1.3.3. Restored application is inspected and tested according to established procedures

2. Resource Implication	The following resources should be provided: 2.1. Appropriate supplies and materials 2.2. Applicable equipment 2.3. Appropriate software 2.4. Workplace or assessment area
3. Method of Assessment	Competency in this unit may be assessed through: 3.1. Demonstration with oral questioning 3.2. Written Exam 3.3. Portfolio with interview
4. Context of Assessment	4.1. Competency may be assessed in the actual workplace or at the designated TESDA Accredited Assessment Center.

SECTION 3 TRAINEE ENTRY REQUIREMENTS, TRAINER'S QUALIFICATIONS, LIST OF TOOLS, MATERIALS AND EQUIPMENT; AND TRAINING FACILITIES

3.1   TRAINEE ENTRY REQUIREMENTS

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

- At least knowledgeable in SCADA operations
- At least knowledgeable in industrial automation software concepts preferably in Human Machine Interface (HMI)
- Familiar in Microsoft Excel
- Can communicate orally and in writing
- Can perform basic mathematical computations
- Can recognize abstract and 3-dimensional figures
- Must have completed basic education or holder of Alternative Learning Systems (ALS) certificate of completion with grade 10 equivalent
- Physically able to operate/manipulate a computer input device

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

3.2   TRAINERS QUALIFICATIONS

- Must be a holder of Trainer's Methodology Certificate (TMC) **OR** must be a SCADA certified training provider
- Must have at least 2 years related industry experience on SCADA programming or at least 3 years teaching experience, and at least 36 hours of relevant training of SCADA programming within the last five (5) years
- Must be able to communicate, both orally and in writing
- Must be physically and mentally fit

3.3   LIST OF TOOLS, EQUIPMENT AND MATERIALS

Recommended list of tools, equipment and materials for the conduct of training in SCADA Programming Level III:

TOOLS		
Qty.	Unit	Description/Specification
10	unit	SCADA Software license*
1	lot	Presentation Materials
10	unit	Chair
10	unit	Table
1	lot	References

 * *Can be either educational, license or open-source software*

EQUIPMENT		
Qty.	**Unit**	**Description/Specification**
10	unit	Laptop/Computer (8 GB RAM min; Win 8.1/10 Professional/Enterprise or better)
1	unit	Digital light projector
1	unit	Printer (A4 size)
1	unit	Copier machine (A4 size)

MATERIALS		
Qty.	**Unit**	**Description/Specification**
10	ream	Bond paper (A4)
3	unit	Printer ink (black/colored)

Due to the fast-changing nature of technology, the experts may recommend to TVET providers other similar up-to-date tools, equipment and materials with equivalent functions as alternatives and to be provided and used by their trainees, whichever is appropriate and applicable. This also applies in consideration of community practices and their availability in the local market.

3.4 TRAINING FACILITIES

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
Computer/ Laboratory/ Lecture Area	5 x 10	50	1	50
Learning Resource Area	3 x 5	15	1	15
Wash & Toilet Area	2 x 2	4	2	8
Admin and Staff Room	4 X 5	20	1	20
Total				93
Facilities / Equipment / Circulation (*Area requirement is equivalent to 30% of the total teaching/learning areas*)				19
Total Area				**112**

Note: Subject to conformity of the health and safety protocols

Appropriate consideration should be given in providing and allocating workspace, communications facilities, and the usual workplace amenities to ensure a proper learning environment. Where applicable, training shall be held or conducted in learning facilities in accordance with generally accepted industry standards and practice.

GLOSSARY OF TERMS

GENERAL

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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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) **Required 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

22) **Required 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

23) **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

SPECIFIC

1) **Alarm** - is a notification or message that informs the operator of what's happening at the plant. These events can range from routine maintenance alerts all the way up to plant emergencies.

2) **Alarm management -** is a system for prioritizing, grouping and classifying alerts and event notifications used in supervisory control and data acquisition (SCADA). Alarm management functions similarly in other applications such as IT and medical care.

3) **HMI** - Human machine interfaces (HMIs) are used as an operator control panel to PLCs, RTUs, and in some cases directly to IEDs. HMIs replace manually activated switches, dials, and other controls with graphical representations of the control process and digital controls to influence that process.

4) **P&ID** - a piping and instrumentation diagram, or P&ID, shows the piping and related components of a physical process flow. It is most commonly used in the engineering field.

5) **PLC** - stands for programmable logic controller. A programmable logic controller is installed to monitor sensors. In this manner, a PLC stands for data collection, receiving critical information about the flow and input within the system.

6) **SCADA** – Supervisory Control and Data Acquisition; It is a control system architecture comprising computers, networked data communications and graphical user interfaces for high-level supervision of machines and processes.

7) **SCADA script** - is an advanced feature of a basic system. It is required mainly if the user need to customize the integration for some uncommon scenario, or anything other unique behavior which ordinary settings could not achieve. For example, some operation which requires mathematics calculation.

8) **SCADA security** - is the practice of protecting supervisory control and data acquisition (SCADA) networks, a common framework of control systems used in industrial operations.

9) **SCADA software** - is a system of software and hardware elements that allows industrial organizations to: Control industrial processes locally or at remote locations. Monitor, gather, and process real-time data.

10) **SCADA system alarms** - notify the operator of power supply issues (activation of the SCADA UPS and backup power supply) and network issues such as loss of IP connection. The most common SCADA alarm is "Device Down," which occurs when a device stops communicating on the network.

11) **Situational Awareness Library -** a Library of Symbols that includes symbols designed to help operators extract useful information with minimal effort

12) **Tags** - are the placeholder of information in SCADA servers; they are similar to OPC items, except that internal tags (results of calculations made by SCADA scripts for example), as well as external tags (information from PLCs or OPC servers) can be used. The sole purpose of a tag is to organize and structure your data. These tags are defined within the controller's program, and they are the foundation of the control system's smarts.

13) **Trends** (or charts, graphs) - are essentially important for an industrial automation system. They record real time data from field, retrieve historical data, and present them in graphical ways. SCADA serves as the backbone to an automated system, and it also takes care of trends.

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