COMPETENCY STANDARDS

MOBILE ROBOTICS SYSTEM SERVICING LEVEL II

ELECTRICAL AND ELECTRONICS SECTOR

TECHNICAL EDUCATION AND SKILLS DEVELOPMENT AUTHORITY
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ELECTRICAL AND ELECTRONICS SECTOR

MOBILE ROBOTICS SYSTEM SERVICING LEVEL II

COMPETENCY STANDARDS FOR
MOBILE ROBOTICS SERVICING LEVEL II

Section 1 DEFINITION OF COMPETENCY STANDARDS

The **MOBILE ROBOTICS SYSTEM SERVICING LEVEL II** qualification consists of competencies that a person must achieve to install mobile robots, test mobile robotics system, and service and maintain mobile robots.

The units of competency comprising this qualification includes the following:

Code	BASIC COMPETENCIES
400311210	Participate in workplace communication
400311211	Work in team environment
400311212	Solve/address general workplace problems
400311213	Develop career and life decisions
400311214	Contribute to workplace innovation
00311215	Present relevant information
400311216	Practice occupational safety and health policies and procedures
400311217	Exercise efficient and effective sustainable practices in the workplace
400311218	Practice entrepreneurial skills in the workplace
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 component
Code	**CORE COMPETENCIES**
AB-ELC1381300311301	Install mobile robots
AB-ELC1381300311302	Test mobile robotics system
AB-ELC1381300311303	Service and maintain mobile robots

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

- Mobile Robotics System Technician

SECTION 2 COMPETENCY STANDARD

This section gives the details of the contents of the basic, common, and core units of competency required for **MOBILE ROBOTICS SYSTEM SERVICING LEVEL II.**

BASIC COMPETENCIES

UNIT OF COMPETENCY : PARTICIPATE IN WORKPLACE COMMUNICATION

UNIT CODE : 400311210

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes required to gather, interpret and convey information in response to workplace requirements.

ELEMENTS	PERFORMANCE CRITERIA *Italicized terms* are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Obtain and convey workplace information	1.1 Specific and relevant information is accessed from ***appropriate sources*** 1.2 Effective questioning, active listening and speaking skills are used to gather and convey information 1.3 Appropriate ***medium*** is used to transfer information and ideas 1.4 Appropriate non- verbal communication is used 1.5 Appropriate lines of communication with supervisors and colleagues are identified and followed 1.6 Defined workplace procedures for the location and ***storage*** of information are used 1.7 Personal interaction is carried out clearly and concisely	1.1 Effective verbal and nonverbal communication 1.2 Different modes of communication 1.3 Medium of communication in the workplace 1.4 Organizational policies 1.5 Communication procedures and systems 1.6 Lines of Communication 1.7 Technology relevant to the enterprise and the individual's work responsibilities 1.8 Workplace etiquette	1.1 Effective verbal and nonverbal communication 1.2 Different modes of communication 1.3 Medium of communicatio n in the workplace 1.4 Organizational policies 1.5 Communication procedures and systems 1.6 Lines of Communication 1.7 Technology relevant to the enterprise and the individual's workplace responsibilities etiquette

ELEMENTS	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
2. Perform duties following workplace instructions	2.1 Written notices and instructions are read and interpreted in accordance with organizational guidelines 2.2 Routine written instruction is followed based on established procedures 2.3 Feedback is given to workplace supervisor-based instructions/ information received 2.4 ***Workplace interactions*** are conducted in a courteous manner 2.5 Where necessary, clarifications about routine workplace procedures and matters concerning conditions of employment are sought and asked from ***appropriate sources*** 2.6 Meetings outcomes are interpreted and implemented	2.1 Effective verbal and non-verbal communication 2.2 Different modes of communication 2.3 Medium of communicati on in the workplace 2.4 Medium of communication in the workplace 2.5 Organizational/ Workplace policies 2.6 Communication procedures and systems 2.7 Lines of communication 2.8 Technology relevant to the enterprise and the individual's work responsibiliti es 2.9 Effective questioning techniques (clarifying and probing) 2.10 Workplace etiquette	2.1 Following simple spoken instructions 2.2 Performing routine workplace duties following simple written notices 2.3 Participating in workplace meetings and discussions 2.4 Completing work- related documents 2.5 Estimating, calculating and recording routine workplace measures 2.6 Relating/ Responding to people of various levels in the workplace 2.7 Gathering and providing information in response to workplace requirements 2.8 Basic questioning/qu erying 2.9 Skills in reading for information 2.10 Skills in locating

ELEMENTS	PERFORMANCE CRITERIA *Italicized terms* are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
3. Complete relevant work-related documents	3.1 Range of ***forms*** relating to conditions of employment are completed accurately and legibly 3.2 Workplace data is recorded on standard workplace forms and documents 3.3 Errors in recording information on forms/ documents are identified and acted upon 3.3 Reporting requirements to supervisor are completed according to organizational guidelines	3.1 Effective verbal and non-verbal communication 3.2 Different modes of communication 3.3 Workplace forms and documents 3.4 Organizational/ Workplace policies 3.5 Communication procedures and systems 3.6 Technology relevant to the enterprise and the individual's work responsibilities	3.1 Completing work- related documents 3.2 Applying operations of addition, subtraction, division and multiplication 3.3 Gathering and providing information in response to workplace requirements 3.4 Effective record keeping skills

RANGE OF VARIABLES

VARIABLE	RANGE
1. Appropriate sources	May include: 1.1 Team members 1.2 Supervisor/Department Head 1.3 Suppliers 1.4 Trade personnel 1.5 Local government 1.6 Industry bodies
2. Medium	May include: 2.1 Memorandum 2.2 Circular 2.3 Notice 2.4 Information dissemination 2.5 Follow-up or verbal instructions 2.6 Face-to-face communication 2.7 Electronic media (disk files, cyberspace)
3. Storage	May include: 3.1 Manual filing system 3.2 Computer-based filing system

VARIABLE	RANGE
4. Workplace interactions	May include: 4.1 Face-to-face 4.2 Telephone 4.3 Electronic and two-way radio 4.4 Written including electronic means, memos, instruction and forms 4.5 Non-verbal including gestures, signals, signs and diagrams
5. Forms	May include: 5.1. HR/Personnel forms, telephone message forms, safety reports

EVIDENCE GUIDE

1. Critical aspects of Competency	**Assessment requires evidence that the candidate:** 1.1 Prepared written communication following standard format of the organization 1.2 Accessed information using workplace communication equipment/systems 1.3 Made use of relevant terms as an aid to transfer information effectively 1.4 Conveyed information effectively adopting formal or informal communication
2. Resource Implications	The following resources should be provided: 2.1. Fax machine 2.2. Telephone 2.3. Notebook 2.4. Writing materials 2.5. Computer with Internet connection
3. Methods of Assessment	**Competency in this unit may be assessed through:** 3.1 Demonstration with oral questioning 3.2 Interview 3.3 Written test 3.4 Third-party report
4. Context for Assessment	4.1 Competency may be assessed individually in the actual workplace or through an accredited institution

UNIT OF COMPETENCY : WORK IN A TEAM ENVIRONMENT

UNIT CODE : 400311211

UNIT DESCRIPTOR : This unit covers the skills, knowledge and attitudes to identify one's roles and responsibilities as a member of a team.

ELEMENTS	PERFORMANCE CRITERIA *Italicized terms* are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Describe team role and scope	1.1 The ***role and objective of the team*** is identified from available ***sources of information*** 2.1. Team parameters, reporting relationships and responsibilities are identified from team discussions and appropriate external sources	1.1. Group structure 1.2. Group development 2.1. Sources of information	1.1 Communicating with others, appropriately consistent with the culture of the workplace 2.1. 1.2 Developing ways in improving work structure and performing respective roles in the group or organization
2 Identify one's role and responsibility within a team	2.2. Individual roles and responsibilities within the team environment are identified 2.3. Roles and objectives of the team is identified from available ***sources of information*** 2.4. Team parameters, reporting relationships and responsibilities are identified based on team discussions and appropriate external sources	2.2. Team roles and objectives 2.3. Team structure and parameters 2.4. Team development 2.5. Sources of information	2.2. Team roles and objectives 2.3. Team structure and parameters 2.4. Team development 2.5. Sources of information Instructional planning and delivery skills 2.6. Monitoring and evaluation skills 2.7. Mentoring and coaching skills

ELEMENTS	PERFORMANCE CRITERIA *Italicized terms* are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
3. Work as a team member	3.1 Effective and appropriate forms of communications are used and interactions undertaken with team members based on company practices. 3.2 Effective and appropriate contributions made to complement team activities and objectives, based on workplace context 3.3 Protocols in reporting are observed based on standard company practices. 3.4 Contribute to the development of team work plans based on an understanding of team's role and objectives	3.1. Types and levels of learning evaluation 3.2. Learning styles and strategies 3.3. Training and development approaches 3.4. Communication Process 3.5. Workplace communication 3.6. Protocol 3.7. Team planning and decision making 3.8. Team thinking 3.9. Team roles 3.10. Process of team development 3.11. Workplace context	3.1. Communicating appropriately, consistent with the culture of the workplace 3.2. Interacting effectively with others 3.3. Deciding as an individual and as a group using group think strategies and techniques 3.4. Contributing to Resolution of issues and concerns

RANGE OF VARIABLES

VARIABLE	RANGE
1. Role and objective of team	**May include:** 1.1 Work activities in a team environment with enterprise or specific sector 1.2 Limited discretion, initiative and judgment maybe demonstrated on the job, either individually or in a team environment
2. Sources of information	**May include:** 2.1 Standard operating and/or other workplace procedures 2.2 Job procedures 2.3 Machine/equipment manufacturer's specifications and instructions 2.4 Organizational or external personnel 2.5 Client/supplier instructions 2.6 Quality standards 2.7 OHS and environmental standards

VARIABLE	RANGE
3. Workplace context	**May include:** 3.1 Work procedures and practices 3.2 Conditions of work environments 3.3 Legislation and industrial agreements 3.4 Standard work practice including the storage, safe handling and disposal of chemicals 3.5 Safety, environmental, housekeeping and quality guidelines

EVIDENCE GUIDE

1. Critical aspects of Competency	**Assessment requires evidence that the candidate:** 1.1. Worked in a team to complete workplace activity 1.2. Worked effectively with others 1.3. Conveyed information in written or oral form 1.4. Selected and used appropriate workplace language 1.5. Followed designated work plan for the job
2. Resource Implications	**The following resources should 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 tasks
3. Methods of Assessment	**Competency in this unit may be assessed through:** 3.1. Role play involving the participation of individual member to the attainment of organizational goal 3.2. Case studies and scenarios as a basis for discussion of issues and strategies in teamwork 3.3. Socio-drama and socio-metric methods 3.4. Sensitivity techniques 3.5. Written Test
4. Context for Assessment	4.1. Competency may be assessed in workplace or in a simulated workplace setting 4.2. Assessment shall be observed while task are being undertaken whether individually or in group

UNIT OF COMPETENCY : **SOLVE/ADDRESS GENERAL WORKPLACE PROBLEMS**

UNIT CODE : **400311212**

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes required to apply problem-solving techniques to determine the origin of problems and plan for their resolution. It also includes addressing procedural problems through documentation, and referral.

ELEMENTS	PERFORMANCE CRITERIA *Italicized terms* are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Identify routine problems	1.1 Routine ***problems or procedural problem*** areas are identified 1.2 Problems to be investigated are defined and determined 1.3 Current conditions of the problem are identified and documented	1.1 Current industry hardware and software products and services 1.2 Industry maintenance, service and helpdesk practices, processes and procedures 1.3 Industry standard diagnostic tools 1.4 Malfunctions and resolutions	1.1 Identifying current industry hardware and software products and services 1.2 Identifying current industry maintenance, services and help desk practices, processes and procedures. 1.3 Identifying current industry standard diagnostic tools 1.4 Describing common malfunctions and resolutions. 1.5 Determining the root cause of a routine malfunction

ELEMENTS	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
2. Foster the habit of critical inquiry and curiosity in the workplace.	2.1 Issues and situations are reflected on and wondered about. 2.2 Issues and problems in the workplace particularly in the policies, procedures and protocols are discussed and evaluated between and among teams. 2.3 Evaluation of efficiency and effectiveness of workplace policies, procedures and protocols are documented, communicated and agreed upon between and among teams. 2.4 Growth mindset and positive relationship and communication is applied in the context of ***curiosity and critical inquiry*** in the workplace.	2.1 Different methods of critical and appreciative inquiry and their relevance to different situations. 2.2 Techniques to assist in forming the habit of asking questions and taking responsibility for answers. 2.3 Why questions are important and the benefits of asking good questions for individuals, businesses and communities (the importance of critical thinking). 2.4 Growth mindset and positive communication and relationship strategies and techniques.	2.1 Using a range of analytical techniques (e.g., planning, attention, simultaneous and successive processing of information). 2.2 Communicating to actively listen and to ask questions of others in a constructive way. 2.3 Using critical thinking pathways to formulate and ask relevant questions and come up with appropriate answers. 2.4 Performing assimilation and accommodation skills to interpret and distill key information of relevance to a given situation. 2.5 Assessing and measuring the extent of effectiveness and efficiency of the systems, processes and procedures in the workplace. 2.6 Communicating insights on workplace 2.7 effectiveness and efficiency.

RANGE OF VARIABLES

VARIABLE	RANGE
1. Problems/Procedural Problem	**May include:** 1.1 Routine/non – routine processes and quality problems 1.2 Equipment selection, availability and failure 1.3 Teamwork and work allocation problem 1.4 Safety and emergency situations and incidents 1.5 Work-related problems outside of own work area
2. Appropriate person	**May include:** 2.1 Supervisor or manager 2.2 Peers/work colleagues 2.3 Other members of the organization
3. Document	**May include:** 3.1 Electronic mail 3.2 Briefing notes 3.3 Written report 3.4 Evaluation report
4. Plan	**May include:** 4.1 Priority requirements 4.2 Coordination and feedback requirements 4.3 Safety requirements 4.4 Risk assessment 4.5 Environmental requirements

EVIDENCE GUIDE

1. Critical aspects of Competency	**Assessment requires evidence that the candidate:** 1.1 Determined the root cause of a routine problem 1.2 Identified solutions to procedural problems. 1.3 Produced documentation that recommends solutions to problems. 1.4 Followed established procedures. 1.5 Referred unresolved problems to support persons.
2. Resource Implications	2.1. Assessment will require access to a workplace over an extended period, or a suitable method of gathering evidence of operating ability over a range of situations.
3. Methods of Assessment	**Competency in this unit may be assessed through:** 3.1 Case Formulation 3.2 Life Narrative Inquiry 3.3 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.
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 : **DEVELOP CAREER AND LIFE DECISIONS**
UNIT CODE : **400311213**

UNIT DESCRIPTOR : This unit covers the knowledge, skills, and attitudes in managing one's emotions, developing reflective practice, and boosting self-confidence and developing self-regulation.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Manage one's emotion	1.1 **Self-management strategies** are identified 1.2 Skills to work independently and to show initiative, to be conscientious, and persevering in the face of setbacks and frustrations are developed 1.3 Techniques for effectively handling negative emotions and **unpleasant situation i**n the workplace are examined	1.1 Self-management strategies that assist in regulating behavior and achieving personal and learning goals (e.g.Nine self-management strategies according to Robert Kelley) 1.2 Enablers and barriers in achieving personal and career goals 1.3 Techniques in handling negative emotions and unpleasant situations in the workplace such as frustration, anger, worry, anxiety, etc.	1.1 Managing properly one's emotions and recognizing situations that cannot be changed and accept them and remain professional 1.2 Developing self-discipline, working independently and showing initiative to achieve personal and career goals 1.3 Showing confidence, and resilience in the face of setbacks and frustrations and other negative emotions and unpleasant situations in the workplace

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
2. Develop reflective practice	2.1 Personal strengths and achievements, based on self-assessment strategies and teacher feedback are contemplated 2.2 Progress when seeking and responding to feedback from teachers to assist them in consolidating strengths, addressing weaknesses and fulfilling their potential are monitored 2.3 Outcomes of personal and academic challenges by reflecting on previous problem solving and decision-making strategies and feedback from peers and teachers are predicted	2.1 Basic SWOT analysis 2.2 Strategies to improve one's attitude in the workplace 2.3 Gibbs' Reflective Cycle/Model (Description, Feelings, Evaluation, Analysis, Conclusion, and Action plan)	2.1 Using the basic SWOT analysis as self-assessment strategy 2.2 Developing reflective practice through realization of limitations, likes/ dislikes; through showing of self-confidence 2.3 Demonstrating self-acceptance and being able to accept challenges

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
3. Boost self-confidence and develop self-regulation	3.1 Efforts for continuous self-improvement are demonstrated 3.2 Counter-productive tendencies at work are eliminated 3.3 Positive outlook in life is maintained.	3.1 Four components of self-regulation based on Self-Regulation Theory (SRT) 3.2 Personality development concepts 3.3 Self-help concepts (e. g., 7 Habits by Stephen Covey, transactional analysis, psycho-spiritual concepts)	3.1 Performing effective communication skills – reading, writing, conversing skills 3.2 Showing effective skills – flexibility, adaptability, etc. 3.3 Self-assessment for determining one's strengths and weaknesses

RANGE OF VARIABLES

VARIABLE	RANGE
1. Self-management strategies	**May include:** 1.1 Seeking assistance in the form of job coaching or mentoring 1.2 Continuing dialogue to tackle workplace grievances 1.3 Collective negotiation/bargaining for better working conditions 1.4 Share your goals to improve with a trusted co-worker or supervisor 1.5 Make a negativity log of every instance when you catch yourself complaining to others 1.6 Make lists and schedules for necessary activities
2. Unpleasant situation	**May include:** 2.1 Job burn-out 2.2 Drug dependence 2.3 Sulking

EVIDENCE GUIDE

1. Critical aspects of Competency	**Assessment requires evidence that the candidate:** 1.1 Express emotions appropriately 1.2 Work independently and show initiative 1.3 Consistently demonstrate self-confidence and self-discipline
2. Resource Implications	**The following resources should be provided:** 2.1. Access to workplace and resource s 2.2. Case studies
3. Methods of Assessment	**Competency in this unit may be assessed through:** 3.1. Demonstration or simulation with oral questioning 3.2. Case problems involving work improvement and sustainability issues 3.3. Third-party report
4. Context for Assessment	4.1. Competency assessment may occur in workplace or any appropriately simulated environment

UNIT OF COMPETENCY : CONTRIBUTE TO WORKPLACE INNOVATION

UNIT CODE : 400311214

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes required to make a proactive and positive contribution to workplace innovation.

ELEMENTS	PERFORMANCE CRITERIA *Italicized terms* are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Identify opportunities to do things better	1.1 ***Opportunities for improvement*** are identified proactively in their own area of work. 1.2 ***Information*** is gathered and reviewed which may be relevant to ideas and which might assist in gaining support for ideas.	1.1 Roles of individuals in suggesting and making improvements. 1.2 Positive impacts and challenges in innovation. 1.3 Types of changes and responsibility. 1.4 Seven habits of highly effective people.	1.1 Identifying opportunities to improve and to do things better. Involvement. 1.2 Identifying the positive impacts and the challenges of change and innovation. 1.3 Identifying examples of the types of changes that are within and outside own scope of responsibility
2. Discuss and develop ideas with others	2.1 ***People who could provide input*** to ideas for improvements are identified. 2.2 Ways of approaching people to begin sharing ideas are selected. 2.3 Meeting is set with relevant people. 2.4 Ideas for follow up are reviewed and selected based on feedback. 2.5 ***Critical inquiry method*** is used to discuss and develop ideas with others.	2.1 Roles of individuals in suggesting and making improvements. 2.2 Positive impacts and challenges in innovation. 2.3 Types of changes and responsibility. 2.4 Seven habits of highly effective people.	2.1 Identifying opportunities to improve and to do things better. Involvement. 2.2 Identifying the positive impacts and the challenges of change and innovation. 2.3 Providing examples of the types of changes that are within and outside own scope of responsibility 2.4 Communicating ideas for change

ELEMENTS	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
			through small group discussions and meetings.
3. Integrate ideas for change in the workplace.	3.1 Critical inquiry method is used to integrate different ideas for change of key people. 3.2 Summarizing, analyzing and generalizing skills are used to extract salient points in the pool of ideas. 3.3 ***Reporting skills*** are likewise used to communicate results. 3.4 ***Current Issues and concerns*** on the systems, processes and procedures, as well as the need for simple innovative practices are identified.	3.1 Roles of individuals in suggesting and making improvements. 3.2 Positive impacts and challenges in innovation. 3.3 Types of changes and responsibility. 3.4 Seven habits of highly effective people. 3.5 Basic research skills.	3.1 Identifying opportunities to improve and to do things better. Involvement. 3.2 Identifying the positive impacts and the challenges of change and innovation. 3.3 Providing examples of the types of changes that are within and outside their own scope of responsibility. 3.4 Communicating ideas for change through small group discussions and meetings. 3.5 Demonstrating skills in analysis and interpretation of data.

RANGE OF VARIABLES

VARIABLES	RANGE
1. Opportunities for improvement	May include: 1.1 Systems. 1.2 Processes. 1.3 Procedures. 1.4 Protocols. 1.5 Codes. 1.6 Practices.
2. Information	May include: 2.1 Workplace communication problems. 2.2 Performance evaluation results. 2.3 Team dynamics issues and concerns. 2.4 Challenges on return of investment 2.5 New tools, processes and procedures. 2.6 New people in the organization.
3. People who could provide input	May include: 3.1 Leaders. 3.2 Managers. 3.3 Specialists. 3.4 Associates. 3.5 Researchers. 3.6 Supervisors. 3.7 Staff. 3.8 Consultants (external) 3.9 People outside the organization in the same field or similar expertise/industry. 3.10 Clients
4. Critical inquiry method	May include: 4.1 Preparation. 4.2 Discussion. 4.3 Clarification of goals. 4.4 Negotiate towards a Win-Win outcome. 4.5 Agreement. 4.6 Implementation of a course of action. 4.7 Effective verbal communication. See our pages: Verbal Communication and Effective Speaking. 4.8 Listening. 4.9 Reducing misunderstandings is a key part of effective negotiation. 4.10 Rapport Building. 4.11 Problem Solving. 4.12 Decision Making. 4.13 Assertiveness. 4.14 Dealing with Difficult Situations.

EVIDENCE GUIDE

1. Critical aspects of Competency	**Assessment requires evidence that the candidate:** 1.1 Demonstrated ability and attitude to keep oneself updated of relevant issues/trends 1.2 Demonstrated ability to think and act based on one's principles and values 1.3 Demonstrated a holistic/global outlook on internal and external events in the workplace
2. Resource Implications	**The following resources should be provided:** 2.1 Access to workplace and resources 2.2 Case studies
3. Methods of Assessment	**Competency in this unit may be assessed through:** 3.1 Demonstration or simulation with oral questioning 3.2 Case problems involving global and local issues 3.3 Third-party report
4. Context for Assessment	4.1 Competency assessment may occur in workplace or any appropriately simulated environment

UNIT OF COMPETENCY : **PRESENT RELEVANT INFORMATION**

UNIT CODE : **400311215**

UNIT DESCRIPTOR : This unit of covers the knowledge, skills and attitudes required to present data/information appropriately.

ELEMENTS	PERFORMANCE CRITERIA *Italicized terms* are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Gather data/ information	1.1 Evidence, facts and information are collected 1.2 Evaluation, terms of reference and conditions are reviewed to determine whether data/information falls within project scope	1.1 Organizational protocols 1.2 Confidentiality 1.3 Accuracy 1.4 Business 1.5 mathematics and statistics 1.6 Data analysis techniques/procedures 1.7 Reporting 1.8 requirements to a range of audiences 1.9 Legislation, policy and procedures relating to the conduct of evaluations 1.10 Organizational values, ethics and codes of conduct	1.1 Describing 1.2 organizational protocols relating to client liaison 1.3 Protecting 1.4 confidentiality 1.5 Describing 1.6 accuracy 1.7 Computing business mathematics and statistics 1.8 Describing data analysis techniques/ procedures 1.9 Reporting 1.10 requirements to a range of audiences 1.11 Stating legislation, policy and procedures relating to the conduct of evaluations 1.12 Stating organizational values, ethics and codes of conduct

ELEMENTS	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
2. Assess gathered data/ information	2.1 Validity of data/ information is assessed 2.2 Analysis techniques are applied to assess data/ information. 2.3 Trends and anomalies are identified 2.4 ***Data analysis techniques*** and procedures are documented 2.5 Recommendations are made on areas of possible improvement	2.1 Business mathematics and statistics 2.2 Data analysis techniques/ procedures 2.3 Reporting requirements to a range of audiences 2.4 Legislation, policy and procedures relating to the conduct of evaluations 2.5 Organizational values, ethics and codes of conduct	2.1 Computing business mathematics and statistics 2.2 Describing data analysis techniques/ procedures 2.3 Reporting requirements to a range of audiences 2.4 Stating legislation, policy and procedures relating to the conduct of evaluations 2.5 Stating organizational values, ethics and codes of conduct
3. Record and present information	3.1 Studied data/information are recorded. 3.2 Recommendations are analyzed for action to ensure they are compatible with the project's scope and terms of reference. 3.3 Interim and final reports are analyzed and outcomes are compared to the criteria established at the outset. 3.4 Findings are presented to stakeholders.	3.1 Data analysis techniques/ procedures 3.2 Reporting requirements to a range of audiences 3.3 Legislation, policy and procedures relating to the conduct of evaluations 3.4 Organizational values, ethics and codes of conduct	3.1 Describing data analysis techniques/ procedures 3.2 Reporting requirements to a range of audiences 3.3 Stating legislation, policy and procedures relating to the conduct of evaluations 3.4 Stating organizational values, ethics and codes of conduct practices

RANGE OF VARIABLES

VARIABLES	RANGE
1. Data analysis techniques	May include: 1.1. Domain analysis 1.2. Content analysis 1.3. Comparison technique

EVIDENCE GUIDE

1. Critical aspects of Competency	**Assessment requires evidence that the candidate:** 1.1 Determine data / information 1.2 Studied and applied gathered data/information 1.3 Recorded and studied data/information These aspects may be best assessed using a range of scenarios of what ifs as a stimulus with a walk-through forming part of the response. These assessment activities should include a range of problems, including new, unusual and improbable situations that may have happened.
2. Resource Implications	**Specific resources for assessment** 2.1. Evidence of competent performance should be obtained by observing an individual in an information management role within the workplace or operational or a simulated environment.
3. Methods of Assessment	**Competency in this unit may be assessed through:** 3.1. Written Test 3.2. Interview 3.3. Portfolio 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-throughs of the relevant competency components.
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 : PRACTICE OCCUPATIONAL SAFETY AND HEALTH POLICIES AND PROCEDURES

UNIT CODE : 400311216

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes required to identify OSH compliance requirements, prepare OSH requirements for compliance, perform tasks in accordance with relevant OSH policies and procedures.

ELEMENTS	PERFORMANCE CRITERIA *Italicized terms* are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Identify OSH compliance requirements	1.1 Relevant ***OSH requirements, regulations, policies and procedures*** are identified in accordance with workplace policies and procedures 1.2 OSH activity non-conformities are conveyed to ***appropriate personnel**** 1.3 ***OSH preventive and control requirements*** are identified in accordance with OSH work policies and procedures	1.1 OSH preventive and control requirements 1.2 Hierarchy of Controls 1.3 Hazard 1.4 Prevention and Control 1.5 General OSH principles 1.6 Work standards and procedures 1.7 Safe handling procedures of tools, equipment and materials 1.8 Standard emergency plan and procedures in the workplace	1.1 Communication skills 1.2 Interpersonal skills 1.3 Critical thinking skills 1.4 Observation skills
2. Prepare OSH requirements for compliance	2.1 OSH work activity material, tools and equipment requirements are identified in accordance with workplace policies and procedures 2.2. Required OSH materials, tools and equipment are acquired in	2.1 Resources necessary to execute hierarchy of controls 2.2 General OSH principles 2.3 Work standards and procedures 2.4 Safe handling 2.5 procedures of tools, equipment and materials	2.1 Communication skills 2.2 Estimation skills 2.3 Interpersonal skills 2.4 Critical thinking skills 2.5 Observation skills 2.6 Material, tool and equipment

ELEMENTS	PERFORMANCE CRITERIA *Italicized terms* are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	accordance with workplace policies and procedures 2.3. Required OSH materials, tools and equipment are arranged/ placed in accordance with OSH work standards	2.6 Different OSH control measures	identification skills
3. Perform tasks in accordance with relevant OSH policies and procedures	3.1 Relevant OSH work procedures are identified in accordance with workplace policies and procedures 3.2 Work Activities are executed in accordance with OSH work standards 3.3 ***Non-compliance work activities*** are reported to *appropriate personnel*	3.1 OSH work standards 3.2 Industry related work activities 3.3 General OSH principles 3.4 OSH Violations Non-compliance work activities	3.1 Communication skills 3.2 Interpersonal skills 3.3 Troubleshooting skills 3.4 Critical thinking skills 3.5 Observation skills

RANGE OF VARIABLES

VARIABLE	RANGE
1. OSH Requirements, Regulations, Policies and Procedures	**May include:** 1.1 Clean Air Act 1.2 Building code 1.3 National Electrical and Fire Safety Codes 1.4 Waste management statutes and rules 1.5 Permit to Operate 1.6 Philippine Occupational Safety and Health Standards 1.7 Department Order No. 13 (Construction Safety and Health) 1.8 ECC regulations

VARIABLE	RANGE
2. Appropriate Personnel	**May include:** 2.1 Manager 2.2 Safety Officer 2.3 EHS Offices 2.4 Supervisors 2.5 Team Leaders 2.6 Administrators 2.7 Stakeholders 2.8 Government Official 2.9 Key Personnel 2.10 Specialists 2.11 Himself
3. OSH Preventive and Control Requirements	**May include:** 3.1 Resources needed for removing hazard effectively 3.2 Resources needed for substitution or replacement 3.3 Resources needed to establishing engineering controls 3.4 Resources needed for enforcing administrative controls 3.5 Personal Protective equipment
4. Non OSH-Compliance Work Activities	**May include non-compliance or observance of the following safety measures:** 4.1 Violations that may lead to serious physical harm or death 4.2 Fall Protection 4.3 Hazard Communication 4.4 Respiratory Protection 4.5 Power Industrial Trucks 4.6 Lockout/Tag-out 4.7 Working at heights (use of ladder, scaffolding) 4.8 Electrical Wiring Methods 4.9 Machine Guarding 4.10 Electrical General Requirements 4.11 Asbestos work requirements 4.12 Excavations work requirements

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1. Convey OSH work non-conformities to appropriate personnel* 1.2. Identify OSH preventive and control requirements in accordance with OSH work policies and procedures 1.3. Identify OSH work activity material, tools and equipment requirements in accordance with workplace policies and procedures 1.4. Arrange/Place required OSH materials, tools and equipment in accordance with OSH work standards 1.5. Execute work activities in accordance with OSH work standards 1.6. Report OSH activity non-compliance work activities to appropriate personnel
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
4. Context for Assessment	4.1 Competency may be assessed in the workplace or in a simulated workplace setting

UNIT OF COMPETENCY	**:**	**EXERCISE EFFICIENT AND EFFECTIVE SUSTAINABLE PRACTICES IN THE WORKPLACE**
UNIT CODE	**:**	**400311217**
UNIT DESCRIPTOR	**:**	This unit covers knowledge, skills and attitude to identify the efficiency and effectiveness of resource utilization, determine causes of inefficiency and/or ineffectiveness of resource utilization and Convey inefficient and ineffective environmental practices

ELEMENTS	**PERFORMANCE CRITERIA** *Italicized terms* are elaborated in the Range of Variables	**REQUIRED KNOWLEDGE**	**REQUIRED SKILLS**
1. Identify the efficiency and effectiveness of resource utilization	1.1 Required resource utilization in the workplace is measured using appropriate techniques 1.2 Data are recorded in accordance with workplace protocol 1.3 Recorded data are compared to determine the efficiency and effectiveness of resource utilization according to established ***environmental work procedures***	1.1 Importance of Environmental Literacy 1.2 Environmental Work Procedures 1.3 Waste 1.4 Minimization 1.5 Efficient Energy Consumptions	1.1 Recording Skills 1.2 Writing Skills 1.3 Innovation Skills
2. Determine causes of inefficiency and/or ineffectiveness of resource utilization	2.1 Potential causes of inefficiency and/or ineffectiveness are listed 2.2 Causes of inefficiency and/or ineffectiveness are identified through deductive reasoning 2.3 Identified causes of inefficiency and/or ineffectiveness are validated thru established ***environmental procedures***	2.1 Causes of environmental inefficiencies and ineffectiveness	2.1 Deductive 2.2 Reasoning Skills 2.3 Critical thinking 2.4 Problem Solving 2.5 Observation Skills

ELEMENTS	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
3. Convey inefficient and ineffective environmental practices	3.1 Efficiency and effectiveness of resource utilization are reported to ***appropriate personnel*** 3.2 Concerns related resource utilization are discussed with appropriate personnel 3.3 Feedback on information/ concerns raised are clarified with appropriate personnel	3.1 Appropriate Personnel to address the environmental hazards 3.2 Environmental corrective actions	3.1 Written and Oral Communication Skills 3.2 Critical thinking 3.3 Problem Solving 3.4 Observation Skills 3.5 Practice 3.6 Environmental Awareness

RANGE OF VARIABLES

VARIABLE	RANGE
1. Environmental Work Procedures	**May include:** 1.1 Utilization of Energy, Water, Fuel Procedures 1.2 Waster Segregation Procedures 1.3 Waste Disposal and Reuse Procedures 1.4 Waste Collection Procedures 1.5 Usage of Hazardous Materials Procedures 1.6 Chemical Application Procedures 1.7 Labeling Procedures
2. Appropriate Personnel	**May include:** 2.1 Manager 2.2 Safety Officer 2.3 EHS Offices 2.4 Supervisors 2.5 Team Leaders 2.6 Administrators 2.7 Stakeholders 2.8 Government Official 2.9 Key Personnel 2.10 Specialists 2.11 Himself

EVIDENCE GUIDE

1. Critical aspects of Competency	**Assessment requires evidence that the candidate:** 1.1. Measured required resource utilization in the workplace using appropriate techniques 1.2. Recorded data in accordance with workplace protocol 1.3. Identified causes of inefficiency and/or ineffectiveness through deductive reasoning 1.4. Validate the identified causes of inefficiency and/or ineffectiveness thru established environmental procedures 1.5. Report efficiency and effectives of resource utilization to appropriate personnel 1.6. Clarify feedback on information/concerns raised with appropriate personnel
2. Resource Implications	**The following resources should be provided:** 2.1 Workplace 2.2 Tools, materials and equipment relevant to the tasks 2.3 PPE 2.4 Manuals and references
3. Methods of Assessment	**Competency in this unit may be assessed through:** 3.1 Demonstration 3.2 Oral questioning 3.3 Written examination
4. Context for Assessment	4.1 Competency assessment may occur in workplace or any appropriately simulated environment 4.2 Assessment shall be observed while task is being undertaken whether individually or in-group

UNIT OF COMPETENCY : PRACTICE ENTREPRENEURIAL SKILLS IN THE WORKPLACE

UNIT CODE : **400311218**

UNIT DESCRIPTOR : This unit covers the outcomes required to apply entrepreneurial workplace best practices and implement cost-effective operations.

ELEMENTS	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Apply entrepreneurial workplace best practices	1.1 ***Good practices*** relating to workplace operations are observed and selected following workplace policy. 1.2 Quality procedures and practices are complied with according to workplace requirements. 1.3 Cost-conscious habits in ***resource utilization*** are applied based on industry standards.	1.1 Workplace best practices, policies and criteria 1.2 Resource 1.3 utilization 1.4 Ways in fostering entrepreneurial attitudes: o Patience o Honesty o Quality-consciousness o Safety-consciousness o Resourcefulness	1.1. Communication skills 1.2. Complying with quality procedures
2. Communicate entrepreneurial workplace best practices	2.1 Observed good practices relating to workplace operations are communicated to the appropriate person. 2.2 Observed quality procedures and practices are communicated to appropriate person 2.3 Cost-conscious habits in resource utilization are communicated based on industry standards.	2.1 Workplace best practices, policies and criteria 2.2 Resource utilization 2.3 Ways in fostering entrepreneurial attitudes: o Patience o Honesty o Quality-consciousness o Safety-consciousness 2.4 Resourcefulness	2.1. Communication skills 2.2. Complying with quality procedure 2.3. Following workplace communication protocol

ELEMENTS	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
3. Implement cost effective operations	3.1 Preservation and optimization of workplace resources is implemented in accordance with enterprise policy 3.2 Judicious use of workplace tools, equipment and materials are observed according to manual and work requirements. 3.3 Constructive contributions to office operations are made according to enterprise requirements. 2.4 Ability to work within one's allotted time and finances is sustained	3.1 Optimization of workplace resources 3.2 5S procedures and concepts 3.3 Criteria for cost-effectiveness 3.4 Workplace productivity 3.5 Impact of entrepreneurial mindset to workplace productivity 3.6 Ways in fostering entrepreneurial attitudes: o Quality-consciousness 2.5 Safety-consciousness	3.1. Implementing preservation and optimizing workplace resources 3.2. Observing judicious use of workplace tools, equipment and materials 3.3. Making constructive contributions to office operations 2.4. Sustaining ability to work within allotted time and finances

RANGE OF VARIABLES

VARIABLE	RANGE
1.Good practices	**May include:** 1.1 Economy in use of resources 1.2 Documentation of quality practices
2.Resources utilization	**May include:** 2.1 Consumption/ use of consumables 2.2 Use/Maintenance of assigned equipment and furniture 2.3 Optimum use of allotted /available time

EVIDENCE GUIDE

1. Critical aspects of Competency	**Assessment requires evidence that the candidate:** 1.1 Demonstrated ability to identify and sustain cost-effective activities in the workplace 1.2 Demonstrated ability to practice entrepreneurial knowledge, skills and attitudes in the workplace.
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 2.3.1 Enterprise procedures manuals 2.3.2 Company quality policy
3. Methods of Assessment	**Competency in this unit should be assessed through:** 3.1 Interview 3.2 Third-party report
4. Context of Assessment	4.1 Competency may be assessed in workplace or in a simulated workplace setting 4.2 Assessment shall be observed while tasks are being undertaken whether individually or in-group

COMMON COMPETENCIES

UNIT OF COMPETENCY : 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* terms** are elaborated in the Range of Variable	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 2.1 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 o Proper usage and care of hand tools o Types and	3.1. Reading skills required to interpret work instruction and numerical skills 3.2. Using PPE properly 3.1 Problem solving in emergency situation

ELEMENT	PERFORMANCE CRITERIA *Italicized* **terms** are elaborated in the Range of Variable	REQUIRED KNOWLEDGE	REQUIRED SKILLS
		uses of test equipment 3.4 Common faults in the use of hand tool	
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 o Maintenance of tools 4.3 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 Maintained and stored tools in appropriate location
2. Method of assessment	Competency in this unit must be assessed through: 2.1. Observation 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. puncher 3.1.4. wrenches, files
4. Context of Assessment	4.1. Assessment may be conducted in the workplace or in a simulated environment

UNIT OF COMPETENCY : 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* terms** are elaborated in the Range of Variable	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	2.1. Calculation & measurement 2.2. Four fundamental operation 2.3. Linear measurement 2.4. Dimensions 2.5. Unit conversion 2.6. Ratio and 1.5. proportion	2.1. Performing calculation by addition, subtraction, multiplication and division; 2.2. Interpreting formulas for volume, areas, perimeters of plane and geometric figures 1.2. Handling of measuring

ELEMENT	PERFORMANCE CRITERIA *Italicized* **terms** are elaborated in the Range of Variable	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	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 1.6. Work pieces are measured according to job requirements		instruments
3. Maintain measuring instruments	3.1. Measuring instruments are not dropped to avoid damage 3.2. Measuring instruments are cleaned before and after using. 2.7. 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 2.7. other geometric figures	2.3. Handling and maintaining measuring instruments

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-	2.9 Try-square

VARIABLE	RANGE	
	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	2.10 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 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 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 OF COMPETENCY : 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 ○ Linear measurement ○ Dimension ○ Unit conversion 2.2. Blueprint Reading and Plan Specification ○ Architectural, electrical, electronics, mechanical plan, symbols and abbreviations ○ Drawing standard symbols 2.3. Trade Theory ○ Basic technical drawing ○ Types technical plans ○ Various types	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

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
		of drawings ○ Notes and specifications	
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 ○ Four fundamental operations ○ Percentage ○ Fraction ○ Algebra ○ 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
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. 3.3. 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 ○ Scanner 3.4. 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 3.5. 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 OF COMPETENCY : APPLY QUALITY STANDARDS

UNIT CODE : CS-ELC311204

UNIT DESCRIPTOR : This unit covers the knowledge, skills, (and) attitudes and val needed to apply quality standards in the workplace. The also includes the application of relevant safety procedures regulations, organization procedures and custo 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. Identificatio n of faulty materials related to work	1.1. Reading skills required to interpret work instruction 1.2. Critical thinking 1.3. Interpreting work instructions

ELEMENT	PERFORMANCE CRITERIA ***Italicized Bold*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
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
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
3. 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	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 OF COMPETENCY : 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

ELEMENT	PERFORMANCE CRITERIA ***Italicized Bold*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
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 3.3. ***Desktop icons*** are correctly selected, opened and closed for navigation purposes Keyboard techniques are carried out in line with OH&S requirements for safe use of keyboards	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
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 3.3. 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

ELEMENT	PERFORMANCE CRITERIA ***Italicized Bold*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
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 2.7. 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 2.6. 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 2.5. 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 2.1.4 Equipment 2.1.5 Soldering gun 2.1.6 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 ○ Conversion of Units ○ Applied Mathematics 1.2 Safety ○ Work Safety requirements and economy of materials with durability 1.3 Systems and Processes ○ Principles of electrical / electronic circuits ○ Identifying sources of electricity ○ Identifying conductors and insulators ○ Supplying different voltage using variable power supply ○ Measuring resistance using VOM ○ Testing resistors ○ Measuring current and voltage using VOM 1.4 Testing Criteria ○ Controls ○ Effectiveness ○ Efficiency ○ Bug detection ○ Functionality, including flow ○ Interoperability ○ Performance ○ Reliability ○ Operating	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

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
		parameters	
2. Plan an approach for component testing	2.1 Various ***testing methods*** are Identified based on ***types of electronic components*** Characteristics and appropriateness of testing methods to be used during 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 2.2 ***Records system*** is established to document testing results, including problems and faults	2.1 Safety ○ Work Safety requirements and economy of materials with durability Knowledge in 5S application and observation of required timeframe 2.2 Materials, tools and equipment uses and specifications ○ Proper care and use of tools 2.3 Types of electronic components ○ Passive components ○ Active components ○ Dynamic components ○ Hybrid components 2.4 Testing methods ○ Automated ○ Debugging ○ Inspection ○ Platform testing ○ Prototyping 2.5 Systems and Processes ○ Describing resistance and identify resistors ○ Describing alternating current circuits ○ Describing capacitance and identifying capacitors ○ Describing inductance and identifying inductors ○ Describing the characteris tic of transforme	2.1 Skills in testing electronic components 2.2 Work safety practices and time management 2.3 Planning skills 2.4 Problem solving skills 2.5 Reading skills 2.6 Checking test & measuring instruments and tools 2.7 Documentation skills

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
		rs ○ Describing and identifying semiconductor diode ○ Describing and identifying bipolar transistor ○ Describing and analyzing digital gate	
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 Problems and faults detected during testing are resolved in accordance with agreed project or industry practice 3.3 Evaluate final products against the previously determined criteria 3.4 Testing process is documented and summarized evaluation report is submitted to relevant personnel	3.1 Safety ○ Work Safety requirements and economy of materials with durability 3.2 Materials, tools and equipment uses and specifications 3.3 Proper care and use of tools 3.4 Systems and Processes 3.5 Principles of electrical/ electronic circuits ○ Supplying different voltage using variable power supply ○ Measuring resistance using VOM ○ Testing resistors ○ Measuring current and voltage using VOM ○ Observing waveform using oscilloscope ○ Generating waveform in various frequency using function generator ○ Measuring frequency using	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 3.6 Product analysis and evaluation skills 3.7 Communication skills 3.8 Reading skills

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
		oscilloscope ○ Measuring capacitance using VOM ○ Testing capacitors ○ Testing inductors ○ Testing semiconductor diode ○ Testing bipolar transistor ○ Testing logic gates	
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 ○ Analyzing simple circuit using ohms and power law ○ Analyzing series/parallel circuits using ohms and power law ○ Analyzing series/parallel capacitances ○ Analyzing series parallel inductors ○ Analyzing rectifier circuits ○ Analyzing amplifier circuit ○ Analyzing multi-vibrator circuit ○ Analyzing logic networks ○ 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	Electronic components may include: 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 OF COMPETENCY : INSTALL MOBILE ROBOTS

UNIT CODE : AB-ELC1381300311301

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes required to determine fundamentals of the Mobile robotics system, interpret the robot's instructional manual, identify robot elements, and assemble mobile robots.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Determine fundamentals of the Mobile robotics system	1.1 Different terminologies often used in Mobile Robotics Technology are articulated in accordance with the company requirements 1.2 Types of robots are differentiated according to their functions 1.3 Fundamentals of the Mobile Robotics System are explained based on specified design and materials	**Science** 1.1 Robots 1.2 Types of robots 1.3 Uses of Robots 1.4 Concepts in designing, constructing, and operating the robot **Technology** 1.5 Mobile Robotics System 1.5.1 Intelligent service 1.5.2 Information service	1.1 Communication skills 1.2 Critical thinking skills
2. Interpret robot's instructional manual	2.1 Materials for installation of the robot are prepared according to the ***user guides and installation references*** 2.2 Legends, symbols and standard units are identified in accordance with the instructional manual 2.3 Robot's functionality and installation flow are identified based on the instructional manual	**Communication** 2.1 Robot user guidelines legends, symbols and standard interpretation **Technology** 2.2 Procedures in Setting-up robot	2.1 Communication skills 2.2 Comprehension skills
3. Determine robot elements and its functionality	3.1 ***Robot elements*** are identified based on the instructional manual.	**Technology** 3.1 Fundamental principles and	3.1 Communication skills

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	3.2 Fundamental components of the robot are identified according to the instructional manual 3.3 Functionality of the robot elements are determined based on instructional manual	applications of mobile robotics. 3.2 Mobile Robotics elements 3.2.1 Building System 3.2.2 Electronic components 3.3 Functions of the Robot elements 3.3.1 Building System 3.3.2 Electronic components **Science** 3.4 Science concept and principles	3.2 Comprehension skills
4. Assemble mobile robots	4.1. ***Tools and equipment*** for assembling the robot are prepared according to the instructional manual 4.2 ***Electronic components*** are tested for functionality according to the instructional manual 4.3 ***Robot elements*** are assembled in accordance with the instructional manual 4.4 Robot is assembled in accordance with the product's specification	**Technology** 4.1Types of tools and equipment 4.2Safe handling of tools and devices 4.3Robot building system and its function 4.4Robot electronic components and its functions 4.5Engineering Design Concept **Communication** 4.6 Technical report contents	4.1 Communication skills 4.2 Comprehension skills 4.3 Technical reporting skills 4.4. Organizing and analyzing Skills 4.5. Ability to properly assemble the robot material 4.6. Electronic components testing skills 4.7 Time management skills 4.8 Observing work safety practices

RANGE OF VARIABLES

VARIABLE	RANGE
1. User guides and installation references.	May include: 1.1 Basic User Guide 1.2 Installation Manuals 1.3 Programming Guides 1.4 Safety Manuals 1.5 Maintenance and Troubleshooting Guides
2. Robot elements	May include: 2.1 Mechanical Components 2.2 Electrical Components 2.2.1 Robot Controller 2.2.2 Wiring and Cables 2.2.3 Power Supply 2.3 Software Set up 2.3.1 Programming Environment 2.3.2 Control Software 2.3.3 Safety Features
3. Tools	Tools may include: 3.1 Hand Tools 3.1.1 Screwdrivers (Phillips, flathead, Torx) 3.1.2 Wrenches (adjustable wrench, socket wrench set) 3.1.3 Pliers (needle-nose, cutting, locking) 3.1.4 Allen keys (hex keys) 3.1.5 Wire strippers and crimpers 3.1.6 Nut drivers 3.1.7 Cable ties and fasteners 3.2 Power Tools 3.2.1 Electric drill and drill bits 3.2.2 Power Screwdriver 3.3 Measurement Tools 3.3.1 Tape Measure 3.3.2 Level 3.3.3 Calipers 3.3.4 Protractor 3.4 Robot-Specific Tools 3.4.1 End-effector tooling (grippers, suction cups, tool changers) 3.4.2 Calibration equipment (encoders, alignment jigs) 3.4.3 Programming pendant or teach pendant (for manual robot control) 3.4.4 Robot-specific software (programming software, simulation software)
4. Equipment	Equipment may include: 4.1 Safety Equipment 4.1.1 Safety goggles or glasses 4.1.2 Gloves 4.1.3 Ear protection (earplugs or earmuffs)

VARIABLE	RANGE
	4.2 Electrical Equipment: 4.2.1 Multimeter (for measuring voltage, current, and resistance) 4.2.2 Power supply (for testing and troubleshooting circuits) 4.2.3 Circuit tester 4.2.4 Insulation resistance tester (megger) 4.3 Computer and Networking Equipment 4.3.1 Laptop or desktop computer (for programming and configuring the robot) 4.3.2 Network cables and connectors 4.3.3 Ethernet switch or router 4.3.4 Serial-to-USB adapter (for connecting serial devices to a computer)
5. Electronic components	May include: 5.1 Robot Controllers 5.2 Motor Drivers 5.3 Sensors 5.4 Communication Interface 5.5 Power Supplies 5.6 Devices 5.7 Control Software

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Determined the fundamentals of the Mobile robotics system. 1.1.1 Articulated different terminologies often used in Mobile Robotics Technology 1.1.2 Differentiated types of robots 1.1.3 Explained the Fundamentals of the Mobile Robotics System 1.2 Interpreted the robot's instructional manual. 1.2.1 Prepared materials for installation of the robot 1.2.2 Identified legends, symbols and standard units 1.2.3 Robot's functionality and installation flow 1.3 Determined robot elements and its functionality 1.3.1 Identified robot elements 1.3.2 Identified fundamental components of the robot 1.3.3 Determined functionality of the robot elements 1.4 Assembled robots 1.4.1 Prepared tools and equipment for assembling the robot 1.4.2 Tested electronic components 1.4.3 Assembled robot elements 1.4.4 Assembled robots
2. Resource Implications	The following resources **MUST** be provided: 2.1. Mobile Robotics Materials Equipment 2.2. Tools and Devices 2.3. User Guide 2.4. Installation Manuals 2.5. Safety Manuals 2.6. Maintenance and Troubleshooting Guides
3. Methods of assessment	Competency in this unit must be assessed through 3.1 Direct Observation with oral questioning 3.2 Demonstration with oral questioning 3.3 Written Examination
4. Context for Assessment	4.1. Competency may be assessed in the actual workplace or simulation environment in TESDA accredited institutions.

UNIT OF COMPETENCY : TEST MOBILE ROBOTICS SYSTEM

UNIT CODE : AB-ELC1381300311302

UNIT DESCRIPTOR : This unit covers the knowledge, skills, and attitudes required to identify programming software and its interface, determine mobile robot's objectives and tasks, calibrate the robot, and run the program.

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Identify Programming Software and its functions	1.1 ***Programming software*** and its interface are identified based on the robot's user interface. 1.2 Functions of Programming software and interface are identified based on the robot's user interface. 1.3 ***Programing commands*** and its functions are identified based on the robot's user interface	**Technology** 1.1 Programming software interface 1.2 Functionality of programming commands	1.1 Comprehension Skills 1.2 Communication Skills 1.3 Understanding robot electronic components and its functionality
2. Determine mobile robot's objective and tasks	2.1 Specific objectives and tasks to be performed by the robot are identified based on clients' requirements. 2.2 Key programing commands and functions are identified base on the robot's objective and task.	**Technology** 2.1 Fundamental Principles of Mobile Robotics 2.2 Software Development Tools 2.3 Applications of Robots.	2.1 Comprehension skills 2.2 Communication skills 2.3 Mathematical computation skills 2.4 Basic programming skills
3. Calibrate mobile robot	3.1 Flowcharts and algorithms, outlines of the sequence of actions and decision-making	**Technology** 3.1 Basic Programming blocks 3.2 Mobile Robotics electronics	3.1 Using software testing techniques 3.2 Identifying different

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	steps are determined for specific robotic tasks 3.2 Pseudocode for producing complete code is planned according to the required objectives and tasks 3.3 Conditional and Flow Programming Blocks for decision making are identified based on sensor data 3.4 Mobile Robot is configured based on the motors' motion and sensors' data collection	3.3 Mobile Robotics Electronics Integration 3.4 Flowcharts and algorithms 3.5 Pseudocode to outline algorithms and programs	programming blocks 3.3 Robot Calibrating Skills
4. Run program	4.1 Software programs are tested and debugged based on the ***control algorithm*** 4.2 Software programs are documented and maintained based on performance ***optimization*** 4.3 Programs are stored in ***storage media*** in accordance with the company requirements	**Technology** 4.1 Programming Language 4.2 Robot Operating System 4.3 Control System 4.4 Sensors Integration 4.5 Kinematics 4.6 Machine learning and AI 4.7 Mobile Robotics Simulation	4.1 Organizing Skills 4.2 Basic Programming Skills 4.3 Testing and Debugging Skills 4.4 Interpreting the software program 4.5 Documentation Skills

RANGE OF VARIABLES

VARIABLE	RANGE
1. Programming software	Includes but not limited to: 1.1 Blockly 1.2 Java 1.3 Phyton
2. Programming Commands	Includes but not limited to: 2.1 Action 2.2 Flow Control 2.3 Sensors 2.4 Data Operation 2.5 Advanced Math
3. Control Algorithm	Fundamental Part of the Mobile Robotics System 3.1 Micro controller 3.2 Motors 3.3 Sensors 3.4 Mechanical Structure
4. Performance Optimization	Capabilities and Efficiency 4.1 Speed and Efficiency 4.2 Accuracy and Precision 4.3 Autonomy 4.4 Safety 4.5 Task Flexibility
5. Storage Media	Common storage used to store data, programs, and configuration necessary for robots' operation. 5.1 Solid-State Drives (SSD) 5.2 Hard Disk Drives (HDD) 5.3 Secure Digital Card (SD) 5.4 USB Drives 5.5 External Hard Drives 5.6 Cloud Storage

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Identified Programing Software and its functions 1.1.1 Identified programming software and its interface 1.1.2 Identified programming commands and its functions 1.2 Determined the robot's objective and tasks. 1.2.1 Identified specific objectives and tasks to be performed by the robot 1.2.2 Identified key programing commands and functions 1.3 Calibrated the robot 1.3.1 Determined flowcharts and algorithms, outlines of the sequence of actions and decision-making steps 1.3.2 Planned pseudocode for producing complete code 1.3.3 Identified Conditional and Flow Programming Blocks for decision making 1.3.4 Configured robot 1.4 Ran the program 1.4.1 Tested and debugged software programs. 1.4.2 Documented and maintained software programs 1.4.3 Stored programs
2. Resource Implications	The following resources **MUST** be provided: 2.1 User Guides 2.2 OH&S Policies and Procedure 2.3 Tools and Devices 2.4 Robotic Materials 2.5 Manual and User Guides
3. Methods of Assessment	Competency in this unit must be assessed through 3.1 Direct Observation with oral questioning 3.2 Demonstration with oral questioning 3.2 Written Examination
4. Context for Assessment	Competency may be assessed in the actual workplace or simulation environment in TESDA accredited institutions.

UNIT OF COMPETENCY : SERVICE AND MAINTAIN MOBILE ROBOT

UNIT CODE : AB-ELC1381300311303

UNIT DESCRIPTOR : This unit covers the knowledge, skills, and attitudes required to service and maintain mobile robots.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Service mobile robots	1.1 Performance of the mobile robot is assessed based on their specific tasks and applications 1.2 Repair is performed based on the condition of the mobile robot 1.3 Safety precautions are demonstrated in accordance with the company requirements	**Technology** 1.1 Mobile Robotics Fundamental 1.1.1 Understanding of robot kinematics, dynamics, and control systems 1.1.2 Knowledge of sensors and their applications in mobile robotics. 1.2 Mechanical 1.2.1 Knowledge of mechanical design principles for robot structure and components. 1.2.2 Ability to design and prototype 1.2.3 Understanding of materials and manufacturing process 1.3. Electrical and Electronics 1.3.1 Proficiency in electronics for designing and building robots circuits 1.3.2 Power management and energy efficiency	1.1 Understanding the principle of mobile robotics 1.2 Programming Skills 1.3 Mechanical and Electrical Skills 1.4 Problem Solving Skills 1.5 Troubleshooting Skills 1.6 Safety and Precautions Skills 1.7 Communication Skills 1.8 Project Management Skills

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
		1.4 Types of Programming language for developing robot control 1.5 Simulation tools for testing and refining robot algorithms.	
2. Maintain mobile robots	2.1 ***Hardware*** and electronic components of the robot are checked for functionality 2.2 Robot power supply is monitored and maintained based on the manufacturer's specification 2.3 Sensors are calibrated based on the manufacturer's specification* 2.4 Physical components of the robot are cleaned based on the User Guide. 2.5 Safety Features and mechanism of the robot is inspected according to the ***maintenance*** schedule 2.6 Performance metrics of the mobile robot is continuously monitored and recorded following the	**Technology** 2.1 Physical components of the robot. 2.2 Electrical and Electronics Maintenance: Robot's electrical system including wiring. 2.3 Uses of programming languages for controlling and configuring robots 2.4 Troubleshooting software related problems and updating robot firmware and software. 2.5 Algorithms and logic used in robot navigation and decision making. 2.6 Sensors and Perception Understanding 2.7 Awareness of safety protocols and regulation related to working robots.	2.1 Programming Skills 2.2 Troubleshooting Skills 2.3 Communication Skills 2.3 Calibrating and maintaining sensors for accurate data collection 2.4 Interpreting sensor data collection for robot performance 2.5 Following safety procedures and standards

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	prescribed checklist 2.7 Mobile robot configuration, maintenance history and modifications made to its hardware and ***software*** is documented using the prescribed template		

RANGE OF VARIABLES

VARIABLE	RANGE
1.Hardware	Mobile Robotics Hardware Components Micro Controller 1.1 Motors 1.2 Sensors 1.3 Technic Building System
2.Maintenance	May include: 2.1 Routine Inspection 2.2 Cleaning 2.3 Calibration 2.4 Software Updates 2.5 Replacement of Worn Components 2.6 Backup and Data Managements 2.7 Documentation 2.8 Inventory
3.Software	May include: 3.1 Operating System 3.2 Middleware 3.3 Control Software/Navigation 3.4 Pseudo Codes 3.5 Autonomous Navigation 3.6 Simulation and Testing 3.7 Monitoring and Diagnostics 3.8 Machine learning and AI 3.9 Security and Safety

EVIDENCE GUIDE

1.Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1. Services robots 1.1.1 Assessed performance of the robot 1.1.2 Performed repair 1.1.3 Demonstrated safety precautions 1.2. Maintained robots 1.2.1 Checked hardware and electronic components 1.2.2 Monitored robot power supply 1.2.3 Calibrated sensors 1.2.4 Cleaned physical components of the robot 1.2.5 Inspected safety features and mechanism of the robot 1.2.6 Monitored performance metrics of the robot 1.2.7 Documented robot configuration, maintenance history and modifications made to its hardware and software
2.Resource Implications	The following resources **MUST** be provided: 2.1 User Guides 4.1 OH&S Policies and Procedure 4.2 Tools and Devices 4.3 Robotic Materials 4.4 Manual and User Guides
3.Methods of Assessment	Competency in this unit must be assessed through 3.1 Direct Observation with oral questioning 3.2 Demonstration with oral questioning 3.3 Written Examination
4.Context for Assessment	Competency assessment may be assessed in the actual workplace or simulation environment in TESDA accredited institutions.

GLOSSARY OF TERMS

Calibration - the process of ensuring that a robot's coordinate system is accurately aligned with the coordinate system of its environment; adjusting sensors, actuators, and other components to ensure accurate operation and alignment.

Control Algorithm - a set of facts or a fixed limit that establishes or limits how something can or must happen or be done.

Diagnostic Tools - software or hardware tools used to analyze and diagnose problems in mobile robots.

Firmware - software embedded in the hardware of mobile robots, responsible for controlling basic functions and behavior.

Flow Chart - a flowchart is a picture of the separate steps of a process in sequential order.

Hardware Replacement - swapping malfunctioning or outdated hardware components with new ones to maintain functionality.

Maintenance- regular upkeep and repairs performed on mobile robots to ensure optimal performance and longevity.

Mechanical Structure - encompasses the composition and structure of robots.

Micro Controller - a compact integrated circuit designed to govern a specific operation in an embedded system. A typical microcontroller includes a processor, memory, and input/output (I/O) peripherals on a single chip.

Mobile Robotics - involves the design, construction, operation, and use of robots.

Mobile Robotics System - systems that provide intelligent services and information by interacting with their environment, including human beings, via the use of various sensors, actuators, and human interfaces.

Mobile Robotics Technician - are trained professionals that help to build, test, and maintain robotic equipment.

Motor - are one of the primary mechanisms by which robots move.

Parameters - a set of facts or a fixed limit that establishes or limits how something can or must happen or be done.

Performance Optimization - abstract Optimization in Mobile Robotics are applied to find the best solution.

Preventive Maintenance - scheduled inspections and tasks performed to prevent potential issues and prolong the lifespan of mobile robots.
Programming - refers to a technological process for telling a computer which tasks to perform in order to solve problems.

Pseudo Code - a detailed yet readable description of what a computer program or algorithm should do.

Repair - fixing damaged or broken components of mobile robots to restore functionality.

Robot - a machine—especially one programmable by a computer—capable of carrying out a complex series of actions automatically.

Sensors - a mechanical function used to calculate the condition and environment of a robot.

Software - the programs and other operating information used by a computer.

Software Update - installing newer versions of software to add features, improve performance, or fix bugs in mobile robotics systems.

Troubleshooting - the process of identifying and resolving issues or malfunctions in mobile robotics systems.

User Interface - the point of human-computer interaction and communication in a device. This can include display screens, keyboards, a mouse, and the appearance of a desktop.

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