COMPETENCY STANDARDS

MACHINE LEARNING MODEL DEVELOPMENT LEVEL III

INFORMATION AND COMMUNICATIONS TECHNOLOGY SECTOR

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

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

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

The Competency Standards (CS) serve as basis for the:

1 Registration and delivery of training programs;
2 Development of curriculum and assessment instruments; and
3 Micro-credential program

Each CS has two sections:

Section 1 **Definition of Qualification** describes the qualification and defines the competencies that comprise the qualification.

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

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COMPETENCY STANDARDS FOR

MACHINE LEARNING MODEL DEVELOPMENT LEVEL III

SECTION 1: DEFINITION OF QUALIFICATION

The **MACHINE LEARNING MODEL DEVELOPMENT LEVEL III** qualification consists of competencies that a person must achieve to understand and apply fundamental machine learning concepts, algorithms, and techniques essential for developing and deploying Data Science and Artificial Intelligence systems.

The Units of Competency comprising this Qualification include the following:

UNIT CODE	BASIC COMPETENCIES
400311319	Lead workplace communication
400311320	Lead small teams
400311321	Apply critical thinking and problem-solving techniques in the workplace
400311322	Work in a diverse environment
400311323	Propose methods of applying learning and innovation in the organization
400311324	Use information systematically
400311325	Evaluate occupational safety and health work practices
400311326	Evaluate environmental work practices
400311327	Facilitate entrepreneurial skills for micro-small-medium enterprises (MSMEs)
UNIT CODE	**COMMON COMPETENCIES**
ICT315202	Apply quality standards
ICT311203	Perform Computer Operations
CS-ICT252101	Ensure compliance with data privacy and ethics
UNIT CODE	**CORE COMPETENCIES**
CS-ICT251205	Apply statistical concepts and analysis
CS-ICT251201	Apply programming skills for data manipulation
CS-ICT251202	Apply core machine learning concepts
CS-ICT251203	Develop and deploy classical machine learning models

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

- Junior ML Developer
- AI/ML Junior Researcher

SECTION 2: COMPETENCY STANDARDS

This section gives the details of the contents of the units of competency required in **MACHINE LEARNING MODEL DEVELOPMENT LEVEL III**

BASIC COMPETENCIES

UNIT OF COMPETENCY : LEAD WORKPLACE COMMUNICATION

UNIT CODE : 400311319

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

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Communicate information about workplace processes	1.1. Relevant ***communication method*** is selected based on workplace procedures 1.2. Multiple operations involving several topics/areas are communicated following enterprise requirements 1.3. Questioning is applied to gain extra information 1.4. Relevant sources of information are identified in accordance with workplace/ client requirements 1.5. Information is selected and organized following enterprise procedures	1.1 Organization requirements for written and electronic communication methods 1.2 Effective verbal communication methods 1.3 Business writing 1.4 Workplace etiquette	1.1 Organizing information 1.2 Conveying intended meaning 1.3 Participating in a variety of workplace discussions 1.4 Complying with organization requirements for the use of written and electronic communication methods 1.5 Effective business writing 1.6 Effective clarifying and probing skills 1.7 Effective questioning techniques (clarifying and probing)

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	1.6. Verbal and written reporting is undertaken when required 1.7. Communication and negotiation skills are applied and maintained in all relevant situations		
2. Lead workplace discussions	2.1. Response to workplace issues are sought following enterprise procedures 2.2. Response to workplace issues are provided immediately 2.3. Constructive contributions are made to ***workplace discussions*** on such issues as production, quality and safety 2.4. Goals/objectives and action plans undertaken in the workplace are communicated promptly	2.1 Organization requirements for written and electronic communication methods 2.2 Effective verbal communication methods 2.3 Workplace etiquette	2.1 Organizing information 2.2 Conveying intended meaning 2.3 Participating in variety of workplace discussions 2.4 Complying with organization requirements for the use of written and electronic communication methods 2.5 Effective clarifying and probing skills
3. Identify and communicate issues arising in the workplace	3.1. Issues and problems are identified as they arise 3.2. Information regarding problems and issues are organized coherently to ensure clear and	3.1. Organization requirements for written and electronic communication methods 3.2. Effective verbal communication methods	3.1. Organizing information 3.2. Conveying intended meaning 3.3. Participating in a variety of workplace discussions 3.4. Complying with organization

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	effective communication 3.3. Dialogue is initiated with appropriate personnel 3.4. Communication problems and issues are raised as they arise 3.5. Identify barriers in communication to be addressed appropriately	3.3. Workplace etiquette 3.4. Communication problems and issues 3.5. Barriers in communication	requirements for the use of written and electronic communication methods 3.5. Effective clarifying and probing skills 3.6. Identifying issues 3.7. Negotiation and communication skills

RANGE OF VARIABLES

VARIABLE	RANGE
1. Methods of communication	May include but not limited to: 1.1. Non-verbal gestures 1.2. Verbal 1.3. Face-to-face 1.4. Two-way radio 1.5. Speaking to groups 1.6. Using telephone 1.7. Written 1.8. Internet
2. Workplace discussions	May include but not limited to: 2.1. Coordination meetings 2.2. Toolbox discussion 2.3. Peer-to-peer discussion

EVIDENCE GUIDE

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

UNIT OF COMPETENCY : LEAD SMALL TEAMS

UNIT CODE : 400311320

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

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Provide team leadership	1.1. ***Work requirements*** are identified and presented to team members based on company policies and procedures 1.2. Reasons for instructions and requirements are communicated to team members based on company policies and procedures 1.3. ***Team members' queries and concerns*** are recognized, discussed and dealt with based on company practices	1.1. Facilitation of Team work 1.2. Company policies and procedures relating to work performance 1.3. Performance standards and expectations 1.4. Monitoring individual's and team's performance vis a vis client's and group's expectations	1. Communication skills required for leading teams 2. Group facilitation skills 3. Negotiating skills 4. Setting performance expectation
2. Assign responsibilities	2.1. Responsibilities are allocated having regard to the skills, knowledge and aptitude required to undertake the assigned task based on company policies. 2.2. Duties are allocated having regard to	2.1 Work plan and procedures 2.2 Work requirements and targets 2.3 Individual and group expectations and assignments 2.4 Ways to improve group leadership and membership	2.1 Communication skills 2.2 Management skills 2.3 Negotiating skills 2.4 Evaluation skills 2.5 Identifying team member's strengths and rooms for improvement

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	individual preference, domestic and personal considerations, whenever possible		
3. Set performance expectations for team members	3.1 Performance expectations are established based on client needs 3.2 Performance expectations are based on individual team members knowledge, skills and aptitude 3.3 Performance expectations are discussed and disseminated to individual team members	3.1 One's roles and responsibilities in the team 3.2 Feedback giving and receiving 3.3 Performance expectation	3.1 Communication skills 3.2 Accurate empathy 3.3 Congruence 3.4 Unconditional positive regard 3.5 Handling of Feedback
4. Supervised team performance	4.1 Performance is ***monitored*** based on defined performance criteria and/or assignment instructions 4.2 Team members are provided with ***feedback***, positive support and advice on strategies to overcome any deficiencies based on company practices 4.3 ***Performance issues*** which cannot be	4.1 Performance Coaching 4.2 Performance management 4.3 Performance Issues	4.1 Communication skills required for leading teams 4.2 Coaching skill

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	rectified or addressed within the team are referenced to appropriate personnel according to employer policy 4.4 Team members are kept informed of any changes in the priority allocated to assignments or tasks which might impact on client/customer needs and satisfaction 4.5 Team operations are monitored to ensure that employer/client needs and requirements are met 4.6 Follow-up communication is provided on all issues affecting the team 4.7 All relevant documentation is completed in accordance with company procedures		

RANGE OF VARIABLES

VARIABLE	RANGE
1. Work requirements	May include but not limited to: 1.1. Client Profile 1.2. Assignment instructions
2. Team member's concerns	May include but not limited to: 2.1. Roster/shift details
3. Monitor performance	May include but not limited to: 3.1. Formal process 3.2. Informal process
4. Feedback	May include but not limited to: 4.1. Formal process 4.2. Informal process
5. Performance issues	May include but not limited to: 5.1. Work output 5.2. Work quality 5.3. Team participation 5.4. Compliance with workplace protocols 5.5. Safety 5.6. Customer service

EVIDENCE GUIDE

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

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

UNIT CODE : **400311321**

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

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Examine specific workplace challenges	1.1. Variances are examined from normal operating **parameters;** and product quality 1.2. Extent, cause and nature of the specific problem are defined through observation, investigation and ***analytical techniques*** 1.3. ***Problems*** are clearly stated and specified	1.1. Competence includes a thorough knowledge and understanding of the process, normal operating parameters, and product quality to recognize non-standard situations 1.2. Competence to include the ability to apply and explain, enough for the identification of fundamental causes of specific workplace challenges 1.3. Relevant equipment and operational processes 1.4. Enterprise goals, targets and measures 1.5. Enterprise quality OHS and environmental requirements	1.1. Using range of analytical techniques (e.g., planning, attention, simultaneous and successive processing of information) in examining specific challenges in the workplace 1.2. Identifying extent and causes of specific challenges in the workplace

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
		1.6. Enterprise information systems and data collation 1.7. Industry codes and standards	
2. Analyze the causes of specific workplace challenges.	2.1. Possible causes of specific problems are identified based on experience and the use of problem solving tools **/** analytical techniques 2.2. Possible cause statements are developed based on findings. 2.3. Fundamental causes are identified per results of investigation conducted	2.1 Competence includes a thorough knowledge and understanding of the process, normal operating parameters, and product quality to recognize non-standard situations. 2.2 Competence to include the ability to apply and explain, sufficient for the identification of fundamental cause, determining the corrective action and provision of recommendations. 2.3 Relevant equipment and operational processes. 2.4 Enterprise goals, targets and measures. 2.5 Enterprise quality OSH and environmental requirements. 2.6 Enterprise information	2.1 Using range of analytical techniques (e.g., planning, attention, simultaneous and successive processing of information) in examining specific challenges in the workplace. 2.2 Identifying extent and causes of specific challenges in the workplace. 2.3 Providing clear-cut findings on the nature of each identified workplace challenges.

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
		systems and data collation. 2.7 Industry codes and standards.	
3. Formulate resolutions to specific workplace challenges	3.1. All possible options are considered for resolution of the problem 3.2. Strengths and weaknesses of possible options are considered. 3.3. Corrective actions are determined to resolve the problem and possible future causes 3.4. **Action *plans*** are developed identifying measurable objectives, resource needs and timelines in accordance with safety and operating procedures	3.1. Competence to include the ability to apply and explain, sufficient for the identification of fundamental cause, determining the corrective action and provision of recommendations 3.2. Relevant equipment and operational processes 3.3. Enterprise goals, targets and measures 3.4. Enterprise quality OSH and environmental requirement 3.5. Principles of decision making strategies and techniques 3.6. Enterprise information systems and data collation 3.7. Industry codes and standards	3.1. Using range of analytical techniques (e.g., planning, attention, simultaneous and successive processing of information) in examining specific challenges in the workplace. 3.2. Identifying extent and causes of specific challenges in the workplace. 3.3. Providing clear-cut findings on the nature of each identified workplace challenges. 3.4. Devising, communicating, implementing and evaluating strategies and techniques in addressing specific workplace challenges.
4. Implement action plans and communicate results	4.1. Action plans are implemented and evaluated	4.1 Competence to include the ability to apply and explain,	4.1 Using range of analytical techniques (e.g., planning,

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

RANGE OF VARIABLES

VARIABLE	RANGE
1. Parameters	May include but not limited to: 1.1 Processes 1.2 Procedures 1.3 Systems
2. Analytical techniques	May include but not limited to: 2.1. Brainstorming 2.2. Intuitions/Logic 2.3. Cause and effect diagrams 2.4. Pareto analysis 2.5. SWOT analysis 2.6. Gantt chart, Pert CPM and graphs 2.7. Scattergrams
3. Problem	May include but not limited to: 3.1. Routine, non – routine and complex workplace and quality problems 3.2. Equipment selection, availability and failure 3.3. Teamwork and work allocation problem 3.4. Safety and emergency situations and incidents 3.5. Risk assessment and management
4. Action plans	May include but not limited to: 4.1. Priority requirements 4.2. Measurable objectives 4.3. Resource requirements 4.4. Timelines 4.5. Co-ordination and feedback requirements 4.6. Safety requirements 4.7. Risk assessment 4.8. Environmental requirements

EVIDENCE GUIDE

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

UNIT OF COMPETENCY : WORK IN A DIVERSE ENVIRONMENT

UNIT CODE : 400311322

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

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Develop an individual's cultural awareness and sensitivity	1.1. Individual differences with clients, customers and fellow workers are recognized and respected in accordance with enterprise policies and core values. 1.2. Differences are responded to in a sensitive and considerate manner 1.3. ***Diversity*** is accommodated using appropriate verbal and non-verbal communication.	1.1. Understanding cultural diversity in the workplace 1.2. Norms of behavior for interacting and dialogue with specific groups (e. g., Muslims and other non-Christians, non-Catholics, tribes/ethnic groups, foreigners) 1.3. Different methods of verbal and non-verbal communication in a multicultural setting	1.1. Applying cross-cultural communication skills (i.e. different business customs, beliefs, communication strategies) 1.2. Showing affective skills – establishing rapport and empathy, understanding, etc. 1.3. Demonstrating openness and flexibility in communication 1.4. Recognizing diverse groups in the workplace and community as defined by divergent culture, religion, traditions and practices
2. Work effectively in an environment that acknowledges and values cultural diversity	2.1 Knowledge, skills and experiences of others are recognized and documented in	2.1 Value of diversity in the economy and society in terms of Workforce development	2.1 Demonstrating cross-cultural communication skills and active listening

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	relation to team objectives. 2.2 Fellow workers are encouraged to utilize and share their specific qualities, skills or backgrounds with other team members and clients to enhance work outcomes. 2.3 Relations with customers and clients are maintained to show that diversity is valued by the business.	2.2 Importance of inclusiveness in a diverse environment 2.3 Shared vision and understanding of and commitment to team, departmental, and organizational goals and objectives 2.4 Strategies for customer service excellence	2.2 Recognizing diverse groups in the workplace and community as defined by divergent culture, religion, traditions and practices 2.3 Demonstrating collaboration skills 2.4 Exhibiting customer service excellence
3. Identify common issues in a multicultural and diverse environment	3.1 ***Diversity-related conflicts*** within the workplace are effectively addressed and resolved. 3.2 Discriminatory behaviors towards customers/stakeholders are minimized and addressed accordingly. 3.3 Change management policies are in place within the organization.	3.1 Value, and leverage of cultural diversity 3.2 Inclusivity and conflict resolution 3.3 Workplace harassment 3.4 Change management and ways to overcome resistance to change 3.5 Advanced strategies for customer service excellence	3.1 Addressing diversity-related conflicts in the workplace 3.2 Eliminating discriminatory behavior towards customers and co-workers 3.3 Utilizing change management policies in the workplace

RANGE OF VARIABLES

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

EVIDENCE GUIDE

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

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

UNIT CODE : 400311323

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

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Assess work procedures, processes and systems in terms of innovative practices	1.1. ***Reasons*** for innovation are incorporated to work procedures. 1.2. ***Models of innovation*** are researched. 1.3. ***Gaps or barriers*** to innovation in one's work area are analyzed. 1.4. Staff who can support and foster innovation in the work procedure are identified.	1.1 Seven habits of highly effective people. 1.2 Character strengths that foster innovation and learning (Christopher Peterson and Martin Seligman, 2004) 1.3 Five minds of the future concepts (Gardner, 2007). 1.4 Adaptation concepts in neuroscience (Merzenich, 2013). 1.5 Transtheoretical model of behavior change (Prochaska, DiClemente, & Norcross, 1992).	1.1 Demonstrating collaboration and networking skills. 1.2 Applying basic research and evaluation skills 1.3 Generating insights on how to improve organizational procedures, processes and systems through innovation.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
2. Generate practical action plans for improving work procedures, processes	2.1 Ideas for innovative work procedure to foster innovation using individual and group techniques are conceptualized 2.2 Range of ideas with other team members and colleagues are evaluated and discussed 2.3 Work procedures and processes subject to change are selected based on ***workplace requirements*** (feasible and innovative). 2.4 Practical action plans are proposed to facilitate simple changes in the work procedures, processes and systems. 2.5 ***Critical inquiry*** is applied and used to facilitate discourse on adjustments in the simple work procedures, processes and systems.	2.1 Seven habits of highly effective people. 2.2 Character strengths that foster innovation and learning (Christopher Peterson and Martin Seligman, 2004) 2.3 Five minds of the future concepts (Gardner, 2007). 2.4 Adaptation concepts in neuroscience (Merzenich, 2013). 2.5 Transtheoretical model of behavior change (Prochaska, DiClemente, & Norcross, 1992).	2.1 Assessing readiness for change on simple work procedures, processes and systems. 2.2 Generating insights on how to improve organizational procedures, processes and systems through innovation. 2.3 Facilitating action plans on how to apply innovative procedures in the organization.

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

RANGE OF VARIABLES

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

EVIDENCE GUIDE

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

UNIT OF COMPETENCY : USE INFORMATION SYSTEMATICALLY

UNIT CODE : 400311324

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

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Use technical information	1.1. ***Information*** are collated and organized into a suitable form for reference and use 1.2. Stored information are classified so that it can be quickly identified and retrieved when needed 1.3. Guidance are advised and offered to people who need to find and use information	1.1. Application in collating information 1.2. Procedures for inputting, maintaining and archiving information 1.3. Guidance to people who need to find and use information 1.4. Organize information 1.5. classify stored information for identification and retrieval 1.6. Operate the technical information system by using agreed procedures	1.1. Collating information 1.2. Operating appropriate and valid procedures for inputting, maintaining and archiving information 1.3. Advising and offering guidance to people who need to find and use information 1.4. Organizing information into a suitable form for reference and use 1.5. Classifying stored information for identification and retrieval 1.6. Operating the technical information system by using agreed procedures
2. Apply information technology (IT)	2.1. ***Technical information*** system is operated using	2.1. Attributes and limitations of available software tools	2.1. Identifying attributes and limitations of

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	agreed procedures 2.2. Appropriate and valid procedures are operated for inputting, maintaining and archiving information 2.3. ***Software*** required are utilized to execute the project activities 2.4. Information and data obtained are handled, edited, formatted and checked from a range of internal and external ***sources*** 2.5. Information are extracted, entered, and processed to produce the outputs required by ***customers*** 2.6. Own skills and understanding are shared to help others 2.7. Specified ***security measures*** are implemented to protect the confidentiality and integrity of project data held in IT systems	2.2. Procedures and work instructions for the use of IT 2.3. Operational requirements for IT systems 2.4. Sources and flow paths of data 2.5. Security systems and measures that can be used 2.6. Extract data and format reports 2.7. Methods of entering and processing information 2.8. WWW enabled applications	available software tools 2.2. Using procedures and work instructions for the use of IT 2.3. Describing operational requirements for IT systems 2.4. Identifying sources and flow paths of data 2.5. Determining security systems and measures that can be used 2.6. Extracting data and format reports 2.7. Describing methods of entering and processing information 2.8. Using WWW applications
3. Edit, format and check information	3.1 Basic editing techniques are used	3.1 Basic file-handling techniques	3.1 Using basic file-handling techniques is

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	3.2 Accuracy of documents are checked 3.3 Editing and formatting tools and techniques are used for more complex documents 3.4 Proofreading techniques is used to check that documents look professional	3.2 Techniques in checking documents 3.3 Techniques in editing and formatting 3.4 Proof reading techniques	used for the software 3.2 Using different techniques in checking documents 3.3 Applying editing and formatting techniques 3.4 Applying proofreading techniques

RANGE OF VARIABLES

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

EVIDENCE GUIDE

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

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

UNIT CODE : **400311325**

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

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Interpret Occupational Safety and Health practices	1.1 ***OSH work practices issues*** are identified relevant to work requirements 1.2 OSH work standards and procedures are determined based on applicability to nature of work 1.3 Gaps in work practices are identified related to relevant OSH work standards	1.1. OSH work practices issues 1.2. OSH work standards 1.3. General OSH principles and legislations 1.4. Company/ workplace policies/ guidelines 1.5. Standards and safety requirements of work process and procedures	1.1. Communication skills 1.2. Interpersonal skills 1.3. Critical thinking skills 1.4. Observation skills
2. Set OSH work targets	2.1 Relevant work information are gathered necessary to determine OSH work targets 2.2 ***OSH Indicators*** based on gathered information are agreed upon to measure effectiveness of workplace OSH policies and procedures 2.3 Agreed OSH indicators are	2.2. OSH work targets 2.3. OSH Indicators 2.4. OSH work instructions 2.5. Safety and health requirements of tasks 2.6. Workplace guidelines on providing feedback on OSH and security concerns 2.7. OSH regulations	2.1. Communication skills 2.2. Collaborating skills 2.3. Critical thinking skills 2.4. Observation skills

	endorsed for approval from appropriate personnel 2.4 ***OSH work instructions*** are received in accordance with workplace policies and procedures*	Hazard control procedures 2.8. OSH trainings relevant to work	
3. Evaluate effectiveness of Occupational Safety and Health work instructions	3.1 OSH Practices are observed based on workplace standards 3.2 Observed OSH practices are measured against approved ***OSH metrics*** 3.3 Findings regarding effectiveness are assessed and gaps identified are implemented based on OSH work standards	3.1. OSH Practices 3.2. OSH metrics 3.3. OSH Evaluation Techniques 3.4. OSH work standards	3.1. Critical thinking skills 3.2. Evaluating skills

RANGE OF VARIABLES

VARIABLE	RANGE
1. OSH Work Practices Issues	May include but not limited to: 1.1 Workers' experience/observance on presence of work hazards 1.2 Unsafe/unhealthy administrative arrangements (prolonged work hours, no break-time, constant overtime, scheduling of tasks) 1.3 Reasons for compliance/non-compliance to use of PPEs or other OSH procedures/policies/ guidelines
2. OSH Indicators	May include but not limited to: 2.1 Increased of incidents of accidents, injuries 2.2 Increased occurrence of sickness or health complaints/symptoms 2.3 Common complaints of workers' related to OSH 2.4 High absenteeism for work-related reasons
3. OSH Work Instructions	May include but not limited to: 3.1 Preventive and control measures**,** and targets 3.2 Eliminate the hazard (i.e., get rid of the dangerous machine 3.3 Isolate the hazard (i.e. keep the machine in a closed room and operate it remotely; barricade an unsafe area off) 3.4 Substitute the hazard with a safer alternative (i.e., replace the machine with a safer one) 3.5 Use administrative controls to reduce the risk (i.e. give trainings on how to use equipment safely; OSH-related topics, issue warning signages, rotation/shifting work schedule) 3.6 Use engineering controls to reduce the risk (i.e. use safety guards to machine) 3.7 Use personal protective equipment 3.8 Safety, Health and Work Environment Evaluation 3.9 Periodic and/or special medical examinations of workers
4. OSH metrics	May include but not limited to: 4.1 Statistics on incidence of accidents and injuries 4.2 Morbidity (Type and Number of Sickness) 4.3 Mortality (Cause and Number of Deaths) 4.4 Accident Rate

EVIDENCE GUIDE

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

UNIT OF COMPETENCY : EVALUATE ENVIRONMENTAL WORK PRACTICES

UNIT CODE : 400311326

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitude to interpret environmental Issues, establish targets to evaluate environmental practices and evaluate effectiveness of environmental practices

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Interpret environmental practices, policies and procedures	1.1 Environmental work practices issues are identified relevant to work requirements 1.2 Environmental Standards and Procedures nature of work are determined based on Applicability to nature of work 1.3 Gaps in work practices related to Environmental Standards and Procedures are identified	1.1. Environmental Issues 1.2. Environmental Work Procedures 1.3. Environmental Laws 1.4. Environmental Hazardous and Non-Hazardous Materials 1.5. Environmental required license, registration or certification	1.1. Analyzing Environmental Issues and Concerns 1.2. Critical thinking 1.3. Problem Solving 1.4. Observation Skills
2. Establish targets to evaluate environmental practices	2.1. Relevant information is gathered necessary to determine environmental work targets 2.2. Environmental Indicators based on gathered information are set to measure environmental work targets 2.3. Indicators are verified with appropriate personnel	2.1. Environmental Indicators 2.2. Relevant Environment Personnel or expert 2.3. Relevant Environmental Trainings and Seminars	2.1. Investigative Skills 2.2. Critical thinking 2.3. Problem Solving 2.4. Observation Skills

3. Evaluate effectiveness of environmental practices	3.1 Work environmental practices are recorded based on workplace standards 3.2 Recorded work environmental practices are compared against planned indicators 3.3 Findings regarding effectiveness are assessed and gaps identified are implemented based on environment work standards and procedures 3.4 Results of environmental assessment are conveyed to appropriate personnel	3.1 Environmental Practices 3.2 Environmental Standards and Procedures	3.1 Documentation and Record Keeping Skills 3.2 Critical thinking 3.3 Problem Solving 3.4 Observation Skills

RANGE OF VARIABLES

VARIABLE	R A N G E
1. Environmental Practices Issues	May include but not limited to: 1.1 Water Quality 1.2 National and Local Government Issues 1.3 Safety 1.4 Endangered Species 1.5 Noise 1.6 Air Quality 1.7 Historic 1.8 Waste 1.9 Cultural
2. Environmental Indicators	May include but not limited to: 2.1 Noise level 2.2 Lighting (Lumens) 2.3 Air Quality - Toxicity 2.4 Thermal Comfort 2.5 Vibration 2.6 Radiation 2.7 Quantity of the Resources 2.8 Volume

EVIDENCE GUIDE

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

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

UNIT CODE : **400311327**

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

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Develop and maintain micro-small-medium enterprise (MSMEs) skills in the organization	1.1 Appropriate ***business strategies*** are determined and set for the enterprise based on the current and emerging business environment. 1.2 ***Business operations*** are monitored and controlled following established procedures. 1.3 Quality assurance measures are implemented consistently. 1.4 Good relations are maintained with staff/workers. 1.5 Policies and procedures on occupational safety and health and environmental concerns are constantly observed.	1.1 Business models and strategies 1.2 Types and categories of businesses 1.3 Business operation 1.4 Basic Bookkeeping 1.5 Business internal controls 1.6 Basic quality control and assurance concepts 1.7 Government and regulatory processes	1.1 Basic bookkeeping/ accounting skills 1.2 Communication skills 1.3 Building relations with customer and employees 1.4 Building competitive advantage of the enterprise
2. Establish and Maintain client-base/market	2.1 Good customer relations are maintained 2.2 New customers and markets are identified,	2.1 Public relations concepts 2.2 Basic product promotion strategies	2.1 Building customer relations 2.2 Individual marketing skills

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	explored and reached out to. 2.3 Promotions/Incentives are offered to loyal customers 2.4 Additional products and services are evaluated and tried where feasible. 2.5 ***Promotional/advertising initiatives*** are carried out where necessary and feasible.	2.3 Basic market and feasibility studies 2.4 Basic business ethics	2.3 Using basic advertising (posters/ tarpaulins, flyers, social media, etc.)
3. Apply budgeting and financial management skills	3.1 Enterprise is built up and sustained through judicious control of cash flows. 3.2 Profitability of enterprise is ensured through appropriate ***internal controls***. 3.3 Unnecessary or lower-priority expenses and purchases are avoided.	3.1 Cash flow management 3.2 Basic financial management 3.3 Basic financial accounting 3.4 Business internal controls	3.1 Setting business priorities and strategies 3.2 Interpreting basic financial statements 3.3 Preparing business plans

RANGE OF VARIABLES

VARIABLE	RANGE
1. Business strategies	May include but not limited to: 1.1. Developing/Maintaining niche market 1.2. Use of organic/healthy ingredients 1.3. Environment-friendly and sustainable practices 1.4. Offering both affordable and high-quality products and services 1.5. Promotion and marketing strategies (e. g., on-line marketing)
2. Business operations	May include but not limited to: 2.1 Purchasing 2.2 Accounting/Administrative work 2.3 Production/Operations/Sales
3. Internal controls	May include but not limited to: 3.1 Accounting systems 3.2 Financial statements/reports 3.3 Cash management
4. Promotional/ Advertising initiatives	May include but not limited to: 4.1 Use of tarpaulins, brochures, and/or flyers 4.2 Sales, discounts and easy payment terms 4.3 Use of social media/Internet 4.4 "Service with a smile" 4.5 Extra attention to regular customers

EVIDENCE GUIDE

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

UNIT CODE : ICT315202

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

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Assess quality of received materials	1.1. Work instruction is obtained and work is carried out in accordance with standard operating procedures. 1.2. Received ***materials*** are checked against workplace standards and specifications. 1.3. Faulty materials 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 are replaced in accordance with workplace procedures.	1.1. Relevant production processes, materials and products 1.2. Characteristics of materials, software and hardware used in production processes 1.3. Quality checking procedures 1.4. Quality Workplace procedures 1.5. Identification of faulty materials related to work	1.1. Reading skills required to interpret work instruction 1.2. Critical thinking 1.3. Interpreting work instructions

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** 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 ***Errors*** are identified and isolated. 2.4 Information on the quality and other indicators of production performance are recorded in accordance with workplace procedures. 2.5 In cases of deviations from specific ***quality standards***, causes are documented and reported in accordance with the workplace' s 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 relative to workplace assignment.	3.1. Quality improvement processes 3.2. Company customers defined	3.1. Solution providing and decision-making 3.2. Practice company process improvement procedure

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	3.2 Work is carried out in accordance with process improvement procedures. 3.3 Performance of operation or quality of product of service to ensure ***customer*** satisfaction is monitored.		

RANGE OF VARIABLES

VARIABLE	RANGE
1 Materials	1.1 Materials may include but not limited to: 1.1.1. Manuals 1.1.2. Job orders 1.1.3. Instructional videos
2 Faults	2.1 Faults may include but not limited to: 2.1.1. Materials not to specification 2.1.2. Materials contain incorrect/outdated information 2.1.3. Hardware defects 2.1.4. Materials that do not conform with any regulatory agencies
3 Documentation	3.1 Organization work procedures 3.2 Manufacturer's instruction manual 3.3 Customer requirements 3.4 Forms
4 Errors	4.1 Errors may be related but not limited to the following: 4.1.1. Deviation from the requirements of the Client 4.1.2. Deviation from the requirement of the organization
5 Quality standards	5.1 Quality standards may be related but not limited to the following: 5.1.1. Materials 5.1.2. Hardware 5.1.3. Final product 5.1.4. Production processes 5.1.5. Customer service
6 Customer	6.1 Co-worker 6.2 Supplier/Vendor 6.3 Client 6.4 Organization receiving the product or service

EVIDENCE GUIDE

Critical aspect of competency	**Assessment requires evidence that candidate:** Carried out work in accordance with the company's standard operating procedures Performed task according to specifications Reported defects detected in accordance with standard operating procedures Carried out work in accordance with the process improvement procedures
Method of assessment	• **The assessor may select two (2) of the following assessment methods to objectively assess the candidate:** Observation Questioning Practical demonstration
Resource implication	Materials, software and hardware to be used in a real or simulated situation
Context of Assessment	Assessment may be conducted in the workplace or in a simulated environment

UNIT OF COMPETENCY : PERFORM COMPUTER OPERATIONS

UNIT CODE : ICT311203

UNIT DESCRIPTOR : This unit covers the knowledge, skills, (and) attitude 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 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 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	1.1. Main types of computers and basic features of different operating systems 1.2. Main parts of a computer 1.3. Information on hardware and software 1.4. Data security guidelines	1.1. Reading and comprehension skills required to interpret work instruction and to interpret basic user manuals. 1.2. Communication skills to identify lines of communication, request advice, follow instructions and receive feedback. 1.3. Interpreting user manuals and security guidelines
2. Input data into computer	2.1. Data are entered into the computer using appropriate program/application in accordance with company procedures 2.2. Accuracy of information is checked and information is saved in accordance with standard	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

ELEMENT	PERFORMANCE CRITERIA *Italicized terms* are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	operating procedures 2.3. Inputted data are stored in ***storage media*** according to requirements 2.4. Work is performed within ***ergonomic guidelines***		
3. Access information using computer	3.1. Correct program/application is selected based on job requirements 3.2. Program/application containing the information required is accessed according to company procedures 3.3. ***Desktop icons*** are correctly selected, opened and closed for navigation purposes 3.4. Keyboard techniques are carried out in line with OH&S requirements for safe use of keyboards	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	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 terms* are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	operating procedures 4.3. Files, data are transferred between compatible systems using computer software, hardware/ peripheral devices in accordance with standard operating procedures		
5. Maintain computer equipment and systems	5.1. Systems for cleaning, minor ***maintenance*** and replacement of consumables are implemented 5.2. Procedures for ensuring security of data, including regular back-ups and virus checks are implemented in accordance with standard operating procedures 5.3. Basic file maintenance procedures are implemented in line with the standard operating procedures	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 security solution programs 7.7. Cleaning dust from internal and external surfaces

EVIDENCE GUIDE

1. Critical aspect of competency	**Assessment requires evidence that the candidate:** 1.1. Selected and used hardware components correctly and according to the task requirement 1.2. Identified and explain the functions of both hardware and software used, their general features and capabilities 1.3. Produced accurate and complete data in accordance with the requirements 1.4. Used appropriate devices and procedures to transfer files/data accurately 1.5. Maintained computer system
2. Method of assessment	2.1. **The assessor may select two of the following assessment methods to objectively assess the candidate:** 2.1.1. Observation 2.1.2. Questioning 2.1.3. Practical demonstration
3. Resource implication	3.1. 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 work environment

UNIT OF COMPETENCY: ENSURE COMPLIANCE WITH DATA PRIVACY AND ETHICS

UNIT CODE: CS-ICT252101

UNIT DESCRIPTOR: This unit covers the outcomes required to ensure data privacy, ethical handling, and the integrity of data throughout its lifecycle. It includes maintaining compliance with data privacy regulations, applying ethical guidelines, and implementing practices to safeguard data accuracy and reliability across various projects.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Comply with data privacy regulations	1.1. ***Data privacy regulations*** relevant to data handling are identified and followed based on industry standards 1.2. Data handling practices are ensured with Data privacy regulations 1.3. Secure storage practices are implemented to protect personal data based on industry standards	1.1. RA 10173 (Data Privacy Act of 2012). 1.2. Secure data storage protocols, including encryption and access control 1.3 Data Privacy Regulations	1.1. Identifying applicable data privacy regulations during annotation and labeling. 1.2. Following secure data handling procedures 1.3. Storing personal data in compliance with privacy laws
2. Apply ethical standards in data handling	2.1. ***Ethical guidelines*** are applied to avoid bias and promote fairness in data handling processes 2.2. Transparency in data usage is ensured through proper documentation of ***data handling practices***. 2.3. Consent for data usage is obtained and documented following ***ethical standards***	2.1. Knowledge of AI ethics principles, such as fairness, transparency, and accountability 2.2. RA 10175 (Cybercrime Prevention Act of 2012) 2.3. Importance of preventing bias in datasets and ensuring transparent practices	2.1. Applying ethical standards during annotation and labeling to avoid bias 2.2. Documenting data handling and usage practices 2.3. Obtaining and recording user consent for data usage

RANGE OF VARIABLES

VARIABLE	RANGE
1. Data privacy regulations	May include but not limited to: 1.1. RA 10173 (Data Privacy Act of 2012) 1.2. Organizational policies on data privacy
2. Ethical guidelines	May include but not limited to: 2.1. Guidelines to prevent bias in data annotation 2.2. Ethical AI principles 2.3. Transparency and accountability standards
3. Data handling practices	May include but not limited to: 3.1. Secure data transmission 3.2. Data anonymization 3.3. Data encryption
4. Ethical standards	May include but not limited to: 4.1. Fairness 4.2. Avoiding bias 4.3. Transparency 4.4. Accountability

EVIDENCE GUIDE

1. Critical aspects of competency	**Assessment requires evidence that the candidate:** 1.1 Complied with data privacy regulations 1.2 Applied ethical standards in data handling
2. Method of assessment	**The assessor may select from the following assessment methods but not limited to:** 2.1 Observation 2.2 Questioning 2.3 Practical demonstration
3. Resource implication	3.1 Access to relevant privacy regulations and ethical guidelines. 3.2 Documentation tools for compliance and tracking consent. 3.3 AI datasets requiring secure handling and compliance with privacy laws
4. Context of Assessment	4.1 Assessment may be conducted in a workplace or simulated environment.

CORE COMPETENCIES

UNIT OF COMPETENCY: APPLY BASIC STATISTICAL CONCEPTS AND ANALYSIS

UNIT CODE: CS-ICT251205

UNIT DESCRIPTOR: This unit covers the outcomes required in applying key basic statistical concepts and applying statistical analysis.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	Required Knowledge	Required Skills
1. Apply key basic statistical concepts	1.1 Main ***types of data analytics*** are identified based on the job requirements 1.2 Types of ***categorical data*** and ***numerical data*** are identified and determined 1.3 Benefits of data analytics are outlined and determined 1.4 Main ***phases of data analysis*** are identified and applied 1.5 ***Data protection methods*** are applied in analyzing data	1.1 Office productivity tools 1.2 Spreadsheet application 1.3 Basic arithmetic 1.4 Overview on statistics 1.5 Statistical terminologies 1.6 Types of data analytics 1.7 Phases of data analysis 1.8 Data protection methods 1.9 Types of data • categorical • numerical 1.10 Data Privacy Act	1.1 Computer operation skills 1.2 Analytical skills 1.3 Critical thinking skills 1.4 Effective communication skills 1.5 Problem solving skills 1.6 Attention to detail
2. Apply basic statistical analysis	2.1 ***Measures of central tendency*** of a data are identified and determined 2.2 Central tendency value of a data set is calculated using a spreadsheet function 2.3 ***Measures of variation*** of a data set quartile are identified and determined 2.4 Variation of data set are calculated	2.1 Office productivity tools 2.2 Spreadsheet application 2.3 Measures of central tendency 2.4 Measures of variation 2.5 Basic arithmetic 2.6 Statistical analysis	2.1 Computer operation skills 2.2 Analytical skills 2.3 Critical thinking skills 2.4 Effective communication skills 2.5 Problem solving skills 2.6 Attention to detail

			2.7 Data analysis and interpretation

RANGE OF VARIABLES

VARIABLE	RANGE
1. Data analytics	May include: 1.1 Descriptive analysis 1.2 Diagnostic analysis 1.3 Predictive analysis 1.4 Prescriptive analysis 1.5 Quantitative analysis 1.6 Qualitative analysis
2. Categorical data	May include: 2.1 Nominal 2.2 Ordinal
3. Numerical data	May include: 3.1 Discrete 3.2 Continuous
4. Phases of data analysis	May include: 4.1 Data Collection 4.2 Data Cleaning 4.3 Data Exploration 4.4 Data Transformation 4.5 Feature Engineering 4.6 Modeling 4.7 Analysis and Interpretation 4.8 Validation and Evaluation 4.9 Visualization and Reporting
5. Data protection	May include: 5.1 Anonymizing personal data 5.2 Complying with applicable data protection regulations 5.3 Encrypting data
6. Measures of central tendency	May include: 6.1 Mean 6.2 Median 6.3 Mode
7. Measures of variation	May include: 7.1 Range 7.2 Variance 7.3 Standard Deviation

	7.4 Percentiles 7.5 Quartiles

EVIDENCE GUIDE

1. Critical aspects of competency	1.1 Applied key basic statistical concepts 1.2 Applied basic statistical analysis
2. Resource implications	The following resources should be provided: 2.1 Facilities, equipment, tools, materials and supplies relevant to the unit of competency
3. Methods of assessment	Competency in this unit must be assessed through any or combination of the following: 3.1 Demonstration with questioning 3.2 Written Test 3.3 Oral questioning/interview
4. Context for assessment	4.1 Competency maybe assessed in actual workplace or at the designated TESDA accredited Assessment Center

UNIT OF COMPETENCY : APPLY PROGRAMMING SKILLS FOR DATA MANIPULATION

UNIT CODE : CS- ICT251201

UNIT DESCRIPTOR : This unit covers the outcomes required in acquiring programming skills to manipulate, clean, and prepare data for machine learning models. It includes selecting appropriate tools, performing data preprocessing, and optimizing code for efficient data management.

ELEMENT	PERFORMANCE CRITERIA *Italicized terms* are elaborated in the Range of Variables	Required Knowledge	Required Skills
1. Select appropriate programming tools and languages	1.1. Programming tools and ***programming languages*** suitable for data manipulation are identified based on project requirements 1.2. The programming environment is set up with ***data manipulation libraries*** and packages for efficient data handling 1.3. Tools and languages are tested to ensure compatibility with the data types and formats used	1.1. Knowledge of different data sources and how to access them 1.2. Understanding of data formats and their compatibility with machine learning models 1.3. Familiarity with data verification techniques to check data quality	1.1. Programming skills 1.2. Tool selection skills 1.3. Environment setup skills 1.4. Debugging skills 1.5. Library management skills 1.6. Configuration skills
2. Perform data manipulation tasks using programming techniques	2.1. Data ***preprocessing operations*** are performed using appropriate programming	1.1. Knowledge of data preprocessing steps Understanding data structures	1.1. Data structuring skills 1.2. Data management skills

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	Required Knowledge	Required Skills
	techniques. 2.2. ***Data structures*** created and managed programmatically 2.3. ***Advanced data operations*** are implemented programmatically	and their role in data manipulation 1.2. Familiarity with advanced data manipulation techniques 1.3. Database management systems	1.3. Analytical skills 1.4. Data cleaning skills 1.5. Preprocessing skills 1.6. Transformation skills
3. Document and optimize data manipulation code	3.1. Code is documented to ensure readability and ease of maintenance. 3.2. Data manipulation scripts are optimized to enhance efficiency and reduce computational time. 3.3. ***Version control tool*** is used to manage changes and track code updates over time.	2.1. Knowledge of coding best practices and documentation techniques. 2.2. Understanding of code optimization techniques to improve performance. 2.3. Knowledge of version control tools (e.g., Git) for managing code changes	2.1. Code optimization skills 2.2. Performance tuning skills 2.3. Documentation skills 2.4. Using version control tool to track updates and maintain workflow for collaboration

RANGE OF VARIABLE

VARIABLE	RANGE
1. Programming languages	May include but not limited to: 1.1. Python 1.2. R 1.3. SQL 1.4. Bash (or PowerShell)
2. Data manipulation libraries	May include but not limited to: 2.1. Pandas 2.2. NumPy 2.3. Dplyr
3. Data formats	May include but not limited to: 3.1. CSV 3.2. JSON 3.3. XML 3.4. Excel 3.5. TSV 3.6. Parquet 3.7. Arvo
4. Preprocessing operations	May include but not limited to: 4.1. Handling missing values 4.2. Encoding categorical variables 4.3. Normalization 4.4. Data cleaning 4.5. Transformation 4.6. Filtering
5. Version control tools	May include but not limited to: 5.1. Distributed or centralized version control systems 5.2. Repository management and collaboration tools 5.3. Systems for version history, branching, merging, and automation
6. Data structures	May include but not limited: 6.1. Arrays 6.2. Data frames 6.3. Lists 6.4. Dictionaries/Hashmaps
7. Advanced data operations	May include but not limited: 7.1. joins 7.2. merges 7.3. aggregations 7.4. group by operations

EVIDENCE GUIDE

1. Critical aspects of competency	**Assessment requires evidence that the candidate:** 1.1. Selected appropriate programming tools and languages for data manipulation 1.2. Performed data manipulation tasks including cleaning, transformation, and advanced operations 1.3. Documented and optimized code to improve readability and performance 1.4. Used version control to manage code changes and updates
2. Method of assessment	**The assessor may select from the following assessment methods:** 1.1. Observation 1.2. Practical demonstration 1.3. Interviews or questioning 1.4. Review of documentation or reports prepared by the candidate 2.5. Written or oral examinations
3. Resource implication	2.1. Access to programming environments and data manipulation libraries 2.2. Documentation templates for code management 2.3. Version control tools to manage code updates
4. Context of Assessment	Assessment may be conducted in the workplace or in a simulated environment where data manipulation programming tasks can be applied and evaluated.

UNIT OF COMPETENCY : APPLY CORE MACHINE LEARNING CONCEPTS

UNIT CODE : CS- ICT251203

UNIT DESCRIPTOR : This unit covers the outcomes required to apply core machine learning concepts and algorithms, including training, evaluating, and tuning models for improved performance.

ELEMENT	PERFORMANCE CRITERIA *Italicized terms* are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Apply fundamental machine learning paradigms	1.1. ***Machine learning paradigms*** are classified according to their intended use cases 1.2 Features and target variables are defined for training datasets 1.3 ***Machine Learning Algorithms*** are selected based on problem type for classification, regression, or clustering2025	1.1. Knowledge of machine learning paradigms 1.2. Familiarity with feature engineering and identification of target variables2025 1.3. Understanding of when to use specific algorithms	1.1. Paradigm differentiation skills 1.2. Problem identification skills 1.3. Critical thinking skills 1.4. Feature engineering skills 1.5. Data preparation skills 1.6. Algorithm selection skills 1.7. Analytical skills
2. Train and evaluate machine learning models	2.1. Models are trained on training datasets using appropriate algorithms 2.2. Models are evaluated using ***model evaluation metrics***2025 2.3. ***Cross-validation***	2.1. Knowledge of training workflows and best practices2025 2.2. Familiarity with model evaluation metrics2025 2.3. Knowledge of cross-validation	2.1. Model training skills 2.2. Data handling skills 2.3. Model evaluation skills 2.4. Analytical thinking skills 2.5. Model validation skills

ELEMENT	PERFORMANCE CRITERIA *Italicized terms* are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	methods are implemented to improve reliability and avoid overfitting2025	techniques	Data management skills
3. Tune and optimize machine learning models	3.1. ***Hyperparameters*** are tuned using ***hyperparameter tuning techniques*** to optimize model performance2025 3.2. Model performance is compared across algorithms using different evaluation metrics 3.3. Training and evaluation processes are documented to track model development and improvements2025	3.1. Knowledge of hyperparameter tuning techniques such as grid search2025 3.2. Understanding of comparative analysis techniques2025 3.3. Familiarity with best practices for ML documentation2025	3.1. Hyperparameter tuning skills 3.2. Optimization skills 3.3. Performance comparison skills 3.4. Decision-making skills 3.5. Documentation skills 3.6. Communication skills

RANGE OF VARIABLES

VARIABLE	RANGE
1. Machine Learning Paradigms	May include: 1.1. Supervised Learning 1.2. Unsupervised Learning 1.3. Reinforcement Learning
2. Machine Learning Algorithms	May include: 2.1. Linear Regression 2.2. Decision Trees 2.3. K-Means Clustering 2.4. Logistic Regression
3. Model Evaluation Metrics	May include: 3.1. Accuracy 3.2. Precision 3.3. Recall 3.4. F1 Score
4. Hyperparameter Tuning Techniques	May include: 4.1. Grid Search 4.2. Random Search 4.3. Bayesian Optimization
5. Cross-Validation Methods	May include: 5.1. K-Fold Cross-Validation 5.2. Stratified Cross-Validation 5.3. Leave-One-Out Cross-Validation

EVIDENCE GUIDE

1. Critical aspects of competency	**Assessment requires evidence that the candidate:** 1.1. Applied appropriate ML algorithms based on the task requirements 1.2. Trained models using correct datasets and evaluated their performance using relevant metrics 1.3. Implemented cross-validation to ensure model generalization 1.4. Tuned hyperparameters to optimize model performance
2. Method of assessment	**The assessor may select from the following assessment methods**: 2.1. Observation 2.2. Practical demonstration 2.3. Review of model documentation 2.4. Interviews or questioning
3. Resource implication	Resources should include: 3.1. Access to ML tools and libraries 3.2. Documentation templates for training and evaluation 3.3. Datasets for practice and model development
4. Context of Assessment	Assessment may be conducted in the workplace or in a simulated environment where ML concepts can be applied, evaluated, and optimized.

UNIT OF COMPETENCY : **DEVELOP AND DEPLOY CLASSICAL MACHINE LEARNING MODELS**

UNIT CODE : **CS- ICT251203**

UNIT DESCRIPTOR : This unit covers the foundational knowledge and practical skills required to apply core machine learning concepts and algorithms. It includes training models, evaluating their performance using appropriate metrics, and optimizing them through tuning techniques to achieve improved accuracy and reliability.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Apply fundamental machine learning paradigms	1.1. ***Machine learning paradigms*** are classified according to their intended use cases 1.2 Features and target variables are defined for training datasets 1.3 ***Machine Learning Algorithms*** are selected based on problem type and aligned with business objectives. 1.4 ***Machine Learning libraries*** are identified to implement the selected algorithms effectively	1.1. Knowledge of machine learning paradigms 1.2. Familiarity with feature engineering and identification of target variables. 1.3. Understanding of when to use specific algorithms	1.1. Paradigm differentiation skills 1.2. Problem identification skills 1.3. Critical thinking skills 1.4. Dimensionality Reduction 1.5. Feature engineering skills 1.6. Data preparation skills 1.7. Algorithm selection skills 1.8. Analytical skills
2. Train and	2.1. Models are trained	2.1. Knowledge of	2.1. Model training

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
evaluate machine learning models	on training datasets using appropriate algorithms 2.2. Models are evaluated using ***model evaluation metrics***. 2.3. ***Cross-validation methods*** are implemented to improve reliability and avoid overfitting. 2.4. Automated machine learning (AutoML) tools are explored to streamline model training and evaluation. 2.5. ***Model selection*** is documented to track decisions and align with the selected machine learning paradigm.	training workflows and best practices. 2.2. Familiarity with model evaluation metrics. 2.3. Knowledge of cross-validation techniques 2.4. Knowledge on methodology selection and machine learning model selection 2.5. Knowledge of automated machine learning (AutoML) tools	skills 2.2. Data handling skills 2.3. Model evaluation skills 2.4. Analytical thinking skills 2.5. Model validation skills 2.6. Data management skills
3. Tune and optimize machine learning models	3.1. ***Hyperparameters*** are tuned using ***hyperparameter tuning techniques*** to optimize model performance. 3.2. Model performance is compared across algorithms using different evaluation	3.1. Knowledge of hyperparameter tuning techniques such as grid search. 3.2. Understanding of comparative analysis techniques. 3.3. Familiarity with best practices for ML documentation.	3.1. Hyperparameter tuning skills 3.2. Optimization skills 3.3. Performance comparison skills 3.4. Decision-making skills 3.5. Documentation skills 3.6. Communication skills

ELEMENT	PERFORMANCE CRITERIA *Italicized terms* are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	metrics. 3.3. Training and evaluation processes are documented to track model development and improvements.		
4. Deploy models to testing environments	4.1. Models are deployed to cloud platforms, local servers, or sandboxes for testing purposes. 4.2. Deployed models are monitored in the testing environment to ensure performance aligns with expected outcomes. 4.3. Model development life cycle is documented to track changes, testing processes, and reproducibility	4.1. Understanding of cloud platforms and deployment tools 4.2. Knowledge of Monitoring techniques for deployed models. 4.3. Familiarity with ML documentation standards.	4.1. Model deployment skills 4.2. Environment setup skills 4.3. Performance monitoring skills 4.4. Problem-solving skills 4.5. Documentation skills 4.6. Communication skills

RANGE OF VARIABLES

VARIABLE	RANGE
1. Machine Learning Paradigms	May include but not limited to: 1.1. Supervised Learning 1.2. Unsupervised Learning 1.3. Reinforcement Learning 1.4. Self-Supervised Learning
2. Machine Learning Algorithms	May include but not limited to: 2.1. Linear Regression 2.2. Decision Trees 2.3. K-Means Clustering 2.4. Logistic Regression
3. Model Evaluation Metrics	May include but not limited to: 3.1. Accuracy 3.2. Precision 3.3. Recall 3.4. F1 Score
4. Hyperparameter Tuning Techniques	May include but not limited to: 4.1. Grid Search 4.2. Random Search 4.3. Bayesian Optimization
5. Cross-Validation Methods	May include but not limited to: 5.1. K-Fold Cross-Validation 5.2. Stratified Cross-Validation 5.3. Leave-One-Out Cross-Validation
6. Hyperparameters	May include but not limited to: 6.1 learning rate 6.2 batch size
7. Machine Learning Libraries	May include but not limited to: 7.1. TensorFlow 7.2. PyTorch 7.3. Scikit-learn 7.4. Keras 7.5. XGBoost
8. Model Selection	May include but not limited to: 8.1. Regression Models 8.2. Classification Models 8.3. Clustering Models 8.4. Ensemble Models.

EVIDENCE GUIDE

1. Critical aspects of competency	**Assessment requires evidence that the candidate:** 1.1. Applied appropriate ML algorithms based on the task requirements 1.2. Trained models using correct datasets and evaluated their performance using relevant metrics 1.3. Implemented cross-validation to ensure model generalization 1.4. Tuned hyperparameters to optimize model performance
2. Method of assessment	**The assessor may select from the following assessment methods**: 2.1. Observation 2.2. Practical demonstration 2.3. Review of model documentation 2.4. Interviews or questioning
3. Resource implication	**Resources should include:** 3.1. Access to ML tools and libraries 3.2. Documentation templates for training and evaluation 3.3. Datasets for practice and model development
4. Context of Assessment	Assessment may be conducted in the workplace or in a simulated environment where ML concepts can be applied, evaluated, and optimized.

GLOSSARY OF TERMS

Accuracy	A model evaluation metric that measures the ratio of correct predictions to the total number of predictions.
Batch Size	The number of training examples used in one iteration of model training.
Cross-Validation	A technique used to evaluate the performance of a model by dividing the data into training and validation sets multiple times and averaging the results.
Data Splitting	Dividing data into separate sets, typically for training, validation, and testing in machine learning.
Decision Tree	A type of machine learning algorithm that splits data into branches to make decisions based on feature values.
F1 Score	A metric that combines precision and recall to provide a balanced measure of a model's accuracy, especially useful when dealing with imbalanced datasets.
Hyperparameter Tuning	The process of optimizing model parameters that are not learned from data, such as learning rate and batch size, to improve performance.
Overfitting	A scenario where a machine learning model performs well on training data but poorly on unseen test data due to learning noise or irrelevant details.
Regression	A type of machine learning task focused on predicting continuous values, such as prices or temperatures.
Supervised Learning	A type of machine learning where the model is trained on labeled data, learning to predict the correct output based on the input.

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