COMPETENCY STANDARDS

ADDITIVE MANUFACTURING LEVEL II

MANUFACTURING 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 skill standards. The Authority shall develop and implement a certification and accreditation program in which private industry groups 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 Authority.

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

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

Each CS has 2 sections:

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

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

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ADDITIVE MANUFACTURING LEVEL II

COMPETENCY STANDARDS FOR ADDITIVE MANUFACTURING LEVEL II

SECTION 1 COMPETENCY STANDARDS DESCRIPTION

The **ADDITIVE MANUFACTURING LEVEL II** consists of competencies that a person must achieve to prepare additive manufacturing materials, set-up additive manufacturing equipment, operate additive manufacturing equipment, assist in post-processing of 3D printed output, maintain workplace safety, and perform basic maintenance on basic 3D printers.

The Units of Competency comprising this Qualification include the following:

UNIT 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
400311215	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

UNIT CODE	COMMON COMPETENCIES
ADM313201	Interpret Drawings and Sketches
MEE721210	Perform Basic Workshop Measurements & Computations
AFF321203	Contribute to Quality Management System
MEE721205	Use Hand Tools

UNIT CODE	CORE COMPETENCIES
ADM313301	Prepare additive manufacturing materials
ADM313302	Set-up additive manufacturing equipment
ADM313303	Operate additive manufacturing equipment
ADM313304	Perform preliminary post-processing of 3d printed output
ADM313305	Perform basic maintenance on 3d printers

A person who has achieved this Competency Standards is competent to be:

- **Additive Manufacturing Machine Operator**

SECTION 2 COMPETENCY STANDARDS

This section gives the details of the contents of the basic, common and core units of competency required in **ADDITIVE MANUFACTURING LEVEL II.**

BASIC COMPETENCIES

UNIT OF COMPETENCY : PARTICIPATE IN WORKPLACE

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.

ELEMENT	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	1.1 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 Following simple spoken language 1.2 Performing routine workplace duties following simple written notices 1.3 Participating in workplace meetings and discussions 1.4 Preparing work- related documents 1.5 Estimating, calculating and recording routine workplace measures 1.6 Relating/ Interacting with people of various levels in the workplace

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** *terms* are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
	1.6 Defined workplace procedures for the location and ***storage*** of information are used 1.7 Personal interaction is carried out clearly and concisely		1.7 Gathering and providing basic information in response to workplace requirements 1.8 Basic business writing skills 1.9 Interpersonal skills in the workplace 1.10 Active-listening 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 are 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 communication in the workplace 2.4 Organizational/ Workplace policies 2.5 Communication procedures and systems 2.6 Lines of communication 2.7 Technology relevant to the enterprise and the individual's work responsibilities 2.8 Effective questioning techniques (clarifying and probing) 2.9 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

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** *terms* are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
			2.8 Basic questioning/ querying 2.9 Skills in reading for information 2.10 Applying skills in locating
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 3.4 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

VARIABLES	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
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**

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.

ELEMENT	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*** 1.2 Team parameters, reporting relationships and responsibilities are identified from team discussions and appropriate external sources	1.1 Group structure 1.2 Group development 1.3 Sources of information	1.1 Communicating with others, appropriately consistent with the culture of the workplace 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	2.1 Individual roles and responsibilities within the team environment are identified 2.2 Roles and objectives of the team is identified from available sources of information 2.3 Team parameters, reporting relationships and responsibilities are identified based on team discussions and appropriate external sources	2.1 Team roles and objectives 2.2 Team structure and parameters 2.3 Team development 2.4 Sources of information	2.1 Communicating with others, appropriately consistent with the culture of the workplace 2.2 Developing ways in improving work structure and performing respective roles in the group or organization

ELEMENT	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 communication 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 teamwork plans based on an understanding of team's role and objectives	3.1 Communication Process 3.2 Workplace communication protocol 3.3 Team planning and decision making 3.4 Team thinking 3.5 Team roles 3.6 Process of team development 3.7 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 judgement 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
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.

ELEMENT	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 determine 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 helpdesk 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

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** *terms* are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
2. Look for solutions to routine problems	2.1 Potential solutions to problem are identified 2.2 Recommendations about possible solutions are developed, ***documented***, ranked and presented to ***appropriate person*** for decision	2.1 Current industry hardware and software products and services 2.2 Industry service and helpdesk practices, processes and procedures 2.3 Operating systems 2.4 Industry standard diagnostic tools 2.5 Malfunctions and resolutions. 2.6 Root cause analysis	2.1 Identifying current industry hardware and software products and services 2.2 Identifying services and helpdesk practices, processes and procedures. 2.3 Identifying operating system 2.4 Identifying current industry standard diagnostic tools 2.5 Describing common malfunctions and resolutions. 2.6 Determining the root cause of a routine malfunction
3. Recommend solutions to problems	3.1 Implementation of solutions are ***planned*** 3.2 Evaluation of implemented solutions are planned 3.3 Recommended solutions are documented and submit to appropriate person for confirmation	3.1 Standard procedures 3.2 Documentation produce	3.1 Producing documentation that recommends solutions to problems 3.2 Following established procedures

RANGE OF VARIABLES

VARIABLE	RANGE
1. Problems/Procedural Problem	May include but not limited to: 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 but not limited to: 2.1 Supervisor or manager 2.2 Peers/work colleagues 2.3 Other members of the organization
3. Document	May include but not limited to: 3.1 Electronic mail 3.2 Briefing notes 3.3 Written report 3.4 Evaluation report
4. Plan	May include but not limited to: 4.1 Priority requirements 4.2 Co-ordination 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*** in 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
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 A 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 own area of work. 1.2 ***Information*** are gathered and reviewed which may be relevant to ideas and which might assist in gaining support for idea.	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 review 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 through small group discussions and meetings.

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

5. Reporting skills	May include: 5.1 Data management. 5.2 Coding. 5.3 Data analysis and interpretation. 5.4 Coherent writing. 5.5 Speaking.

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Identified opportunities to do things better. 1.2 Discussed and developed ideas with others on how to contribute to workplace innovation. 1.3 Integrated ideas for change in the workplace. 1.4 Analyzed and reported rooms for innovation and learning in the workplace.
2. Resource Implications	The following resources should be provided: 2.1 Pens, papers and writing implements. 2.2 Cartolina. 2.3 Manila papers.
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Psychological and behavioral Interviews. 3.2 Performance Evaluation. 3.3 Life Narrative Inquiry. 3.4 Review of portfolios of evidence and third-party workplace reports of on-the-job performance. 3.5 Sensitivity analysis. 3.6 Organizational analysis. 3.7 Standardized assessment of character strengths and virtues applied.
4. Context for Assessment	4.1 Competency may be assessed individually in the actual workplace or simulation environment in TESDA accredited institutions.

UNIT OF COMPETENCY : 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 mathematics and statistics 1.5 Data analysis techniques/ procedures 1.6 Reporting requirements to a range of audiences 1.7 Legislation, policy and procedures relating to the conduct of evaluations 1.8 Organizational values, ethics and codes of conduct	1.1 Describing organizational protocols relating to client liaison 1.2 Protecting confidentiality 1.3 Describing accuracy 1.4 Computing business mathematics and statistics 1.5 Describing data analysis techniques/ procedures 1.6 Reporting requirements to a range of audiences 1.7 Stating legislation, policy and procedures relating to the conduct of evaluations 1.8 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 but not limited to: 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 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 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 through 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 Prevention and Control 1.4. General OSH principles 1.5. Work standards and procedures 1.6. Safe handling procedures of tools, equipment and materials 1.7. 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

ELEMENTS	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED 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 accordance with workplace policies and procedures 2.3. Required OSH materials, tools and equipment are arranged/ placed in accordance with OSH work standards	2.1 Resources necessary to execute hierarchy of controls 2.2 General OSH Principles 2.3 Work standards and procedures 2.4 Safe handling procedures of tools, equipment and materials 2.5 Different OSH control measures	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 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 3.3 Interpersonal skills 3.4 Troubleshooting skills 3.5 Critical thinking skills 3.6 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
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 work place 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 Minimization 1.4 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 Reasoning Skills 2.2 Critical thinking 2.3 Problem Solving 2.4 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 Environmental Awareness

RANGE OF VARIABLES

VARIABLE	RANGE
1. Environmental Work Procedures	May include: 1.1 Utilization of Energy, Water, Fuel Procedures 1.2 Waste 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 effectiveness 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 are 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 utilization 1.3 Ways in fostering entrepreneurial attitudes: 1.3.1 Patience 1.3.2 Honesty 1.3.3 Quality-consciousness 1.3.4 Safety-consciousness 1.3.5 Resourceful ness	1.1 Communication skills 1.2 Complying with quality procedures

ELEMENTS	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
2. Communicate entrepreneurial workplace best practices	2.1 Observed good practices relating to workplace operations are communicated to ***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: 2.3.1 Patience 2.3.2 Honesty 2.3.3 Quality-consciousness 2.3.4 Safety-Consciousness 2.3.5 Resourcefulness	2.1 Communication skills 2.2 Complying with quality procedures 2.3 Following workplace communication protocol
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. 3.4 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: 3.6.1 Quality-consciousness 3.6.2 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 3.4 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 : INTERPRET DRAWINGS AND SKETCHES

UNIT CODE : ADM313201

UNIT DESCRIPTOR : This unit covers the competencies required to read and interpret drawings and sketches.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Interpret technical drawing	1.1 Dimensions identified as appropriate. 1.2 Instructions identified and followed as required. 1.3 Material requirements identified as required. 1.4 Symbols recognized as appropriate in the ***drawing/ sketch***. 1.5 ***Tolerance***, limits and fits identified in the drawing.	1.1 Alphabet of lines 1.2 Projections 1.3 Drawing symbols 1.4 Dimensioning techniques 1.5 Tolerance, limits and fits 1.6 Engineering materials 1.7 Drawing tools and supplies	1.1 Identifying dimension 1.2 Identifying instruction 1.3 Identifying material 1.4 Recognizing symbols in the drawing 1.5 Identifying tolerance, limits and fits
2. Interpret details from freehand sketch	2.1. Dimensions identified as appropriate. 2.2. Instructions identified and followed as required. 2.3. Material requirements identified as required. 2.4. Symbols recognized as appropriate in the drawing	2.1. Alphabet of lines 2.2. Projections 2.3. Drawing symbols 2.4. Dimensioning techniques 2.5. Tolerance, limits and fits 2.6. Engineering materials 2.7. Drawing tools and supplies	2.1. Identifying dimensions 2.2. Identifying instruction 2.3. Identifying material requirements 2.4. Recognizing symbols

RANGE OF VARIABLES

VARIABLE	RANGE
1. Drawing/sketch	May include: 1.1 Perspective 1.2 Orthographic
2. Tolerance	May include: 2.1 Fit tolerance 2.2 Dimensional tolerance

EVIDENCE GUIDE

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Drawings 1.2 Sketches
2. Resource Implications	The following resources should be provided: 2.1 Drawings or plans 2.2 Sketches 2.3 Measuring tools
3. Method of Assessment	Competency in this unit must be assessed through: 3.1 Direct observation 3.2 Written or oral short answer questions 3.3 Demonstration
4. Context of Assessment	4.1. Competency may be assessed in the actual workplace or at the designated TESDA Accredited Assessment Center.

UNIT OF COMPETENCY : **PERFORM BASIC WORKSHOP MEASUREMENTS AND COMPUTATIONS**

UNIT CODE : **MEE721210**

UNIT DESCRIPTOR : This unit covers the competencies required to perform proper measurement and simple calculations using the four fundamental operations.

ELEMENT	PERFORMANCE CRITERIA *Italicized terms* are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Select and use measuring tools	1.1 ***Measuring tools*** are selected according to the requirement. 1.2 Measuring tools are used according to the requirement 1.3 The measuring technique used is correct and appropriate to the device used.	1.1 Types, purposes and accuracy of measuring instruments 1.2 Capability of measuring instruments 1.3 Part dimensions and tolerances 1.4 Techniques for measuring dimensions	1.1 Selecting measuring tools 1.2 Obtaining accurate measurements 1.3 Determining measuring technique
2. Clean and store measuring tools	2.1 Cleaning of devices undertaken according to standard operating procedures. 2.2 Care of devices undertaken according to manufacturer's specifications. 2.3 Storage of devices undertaken according to standard operating procedures.	2.1 Types, purposes and accuracy of measuring instruments 2.2 Capability of measuring instruments 2.3 Part dimensions and tolerances 2.4 Techniques for measuring dimensions 2.5 Care and storage procedure of measuring tools	2.1 Determining proper care and storage of measuring tools.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
3. Perform four fundamental operations.	3.1 ***Simple computations*** are performed using four fundamental operations. 3.2 Correct formulas are applied to isolate the variable required. 3.3 Simple transposition of variables in the formulae is carried out. 3.4 Unknown variables are solved correctly.	3.1 Linear measurement 3.2 Geometrical measurement 3.3 Ratio and proportion 3.4 Area	3.1 Performing Calculation
4. Perform conversion of units	4.1. Familiarity to English system of measurement is required 4.2. Understanding the metric system is necessary. 4.3. Units are converted to the required figure using the given formula	4.1. English Systems of Measurement 4.2. Metric System of Measurement 4.3. Conversion of units from English to metric and/or vice versa	4.1. Performing Calculation

RANGE OF VARIABLES

VARIABLE	RANGE
1. Measuring instruments	May include: 1.1 Ruler 1.2 Vernier caliper 1.3 Micrometer screw gauge 1.4 Vernier height gauge 1.5 Depth gauge 1.6 Measuring tape
2. Simple computations	May include: 2.1 Addition 2.2 Subtraction 2.3 Multiplication 2.4 Division

EVIDENCE GUIDE

1. Critical Aspects of Competency	**Assessment requires evidence that the candidate:** 1.1 Correctly identified appropriate farm tools and equipment 1.2 Operated farm equipment according to manual specification 1.3 Performed preventive maintenance
2. Resource Implications	**The following resources should be provided:** 2.1 Tools and equipment
3. Method of Assessment	**Competency in this unit must be assessed through:** 3.1 Direct observation 3.2 Practical demonstration 3.3 Third Party Report
4. Context of Assessment	4.1 Competency may be assessed in the actual workplace or at the designated TESDA Accredited Assessment Center.

UNIT OF COMPETENCY : **CONTRIBUTE TO QUALITY MANAGEMENT SYSTEM (QMS)**

UNIT CODE : **AFF321203**

UNIT DESCRIPTOR : This unit involves competence required to control quality management system towards work

ELEMENT	PERFORMANCE CRITERIA *Italicized terms* are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Apply quality management system (QMS)	1.1 Appropriate ***quality systems and procedures*** are applied throughout the production/fabrication process. 1.2 Documented information are properly controlled 1.3 QMS are properly implemented and maintained	1.1 Awareness on applicable quality management system / standards	1.1 Conforming to QMS
2. Apply quality standards to work	2.1 Inspections are conducted throughout the production processes to ensure quality standards are maintained. 2.2 Appropriate quality standards are applied throughout the production/fabrication processes. 2.3 All activities are coordinated throughout the workplace to ensure efficient quality work outcomes. 2.4 Records of work quality are maintained according to the company requirements.	2.1 Awareness on applicable quality management system / standards	2.1 Conforming to QMS

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
3. Protect company property and customer interests	3.1 Possible damage to ***company property*** is avoided by adherence to company quality procedures. 3.2 Quality of work is reviewed to ensure customer requirements and company standards 3.3 Customer feedback system is established.	3.1 Awareness on applicable quality management system / standards	3.1 Conforming to QMS

RANGE OF VARIABLES

VARIABLE	RANGE
1. Quality system and Procedures	May include: 1.1 Work instructions 1.2 Procedures manual 1.3 Safe work procedures 1.4 Equipment maintenance schedules 1.5 Product technical procedures adopted or specifically prepared standards 1.6 Company/industry rules
2. Company property	May include: 2.1 Production and/or fabrication equipment 2.2 Hand and power tools 2.3 OH&S paraphernalia 2.4 Facilities

EVIDENCE GUIDE

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Contributed to QMS towards work 1.2 Applied quality standards to work 1.3 Protected company property and customer interests
2. Resource Implications	The following resources should be provided: 2.1 Quality manuals / procedures 2.2 Applicable Codes, Standards and Specifications 2.3 Company / Industry rules
3. Method of Assessment	Competency in this unit must be assessed through: 3.1 Demonstration 3.2 Written or oral short answer questions
4. Context of Assessment	4.1 Competency may be assessed in the workplace or in a simulated workplace environment or at the designated TESDA Accredited Assessment Center.

UNIT OF COMPETENCY : **USE HAND TOOLS**

UNIT CODE : **MEE721205**

UNIT DESCRIPTOR : This unit covers the competencies required to use hand tools.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Identify and use of Personal Protective Equipment (PPE)	1.1 ***Personal protective equipment (PPE)*** is used in accordance with Rule 1080 of Occupational Safety and Health Standards 1.2 Proper Care and Maintenance of PPEs are performed in accordance with OSHS 1.3 Storage and Disposal of PPE are followed according to OSHS	1.1 OSH rule 1080 work standard 1.2 Company/ workplace policies/ guidelines 1.3 Standards and safety requirements of work process and procedures	1.1 OSH rule 1080 work standard 1.2 Company/ workplace policies/ guidelines 1.3 Standards and safety requirements of work process and procedures
2. Select and use of tools and equipment	2.1 ***Hand tools*** selected are appropriate to the requirements of the ***task***. 2.2 Tools and equipment are inspected according to manufacturer's recommendation 2.3 Tools and equipment are used as per operation manual Instructions.	2.1 Tools and equipment Instruction manual 2.2 Adherence to work requirements	2.1 Communication skills 2.2 Handling of tools And equipment

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
3. Perform simple maintenance of tools and equipment	3.1 Tools and equipment are cleaned and lubricated (***routine maintenance***) according to manufacturer's recommendation. 3.2 Unsafe or defective tools are identified and marked for repair/ decommission according to procedure. 3.3 Minor tools and equipment repair are performed according to manufacturer's instruction or worksite procedure.	3.1 Proper cleaning and oiling. 3.2 Equipment inspection and maintenance. 3.3 Simple repairs of hand tools	3.1 Cleaning and lubricating 3.2 Conducting simple check –up and remedies 3.3 Performing minor repairs

RANGE OF VARIABLES

VARIABLE	RANGE
1. Personal protective Equipment (PPE)	May include: 1.1 Safety goggles 1.2 Safety Shoes 1.3 Apron
2. Hand Tools	May include: 2.1 Chipping Hammer 2.2 Steel brush 2.3 Pliers/Tongs 2.4 Files-bastard cut 2.5 Portable disc grinder 2.6 Try Square 2.7 Steel Rule 2.8 Files-half round 2.9 Adjustable wrench 2.10 C- Clamps
3. Task	May include: 3.1 Testing / Inspection 3.2 Adjusting 3.3 Dismantling 3.4 Assembling
4. Routine Maintenance	May include: 4.1 Cleaning 4.2 Lubricating 4.3 Adjusting 4.4 Simple tool repair

EVIDENCE GUIDE

1. Critical Aspects of Competency	**Assessment** requires evidence that the candidate: 1.1 Selected and used hand tools appropriate to the job 1.2 Performed routine maintenance and storage of hand tools
2. Resource Implications	**The following resources should be provided:** 2.1 Tools, equipment and facilities appropriate to the process or activity 2.2 Materials relevant to the proposed activity
3. Method of Assessment	**Competency in this unit must be assessed through:** 3.1 Demonstration 3.2 Written or oral short answer questions 3.3 Practical exercises
4. Context of Assessment	4.1 Competency maybe assessed in actual workplace or at the designated TESDA Accredited Assessment Center.

CORE COMPETENCIES

UNIT OF COMPETENCY : PREPARE ADDITIVE MANUFACTURING MATERIALS

UNIT CODE : ADM313301

UNIT DESCRIPTOR : This unit covers the knowledge, skills, and attitudes required to handle the inventory of additive manufacturing materials and prepare the necessary tools to support additive manufacturing production and maintenance activities.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Check inventory of additive manufacturing materials*	1.1 Additive manufacturing ***feedstock*** requested based on ***job order*** 1.2 ***Quantity*** and ***quality of material*** checked based on job order.	**SCIENCE** 1.1 Additive Manufacturing Material Properties 1.2 Proper Handling Requirements 1.3 Condition of additive manufacturing materials. **TECHNOLOGY** 1.1 Use of Inventory Management Systems **MATHEMATICS** 1.1 Quantity of additive manufacturing materials. **COMMUNICATION** 1.1 Inventory Process 1.2 Inventory Forms 1.3 Inventory Protocols **ENVIRONMENT** 1.1 Proper material storage handling	1.1 Verifying additive manufacturing material quantities, descriptions, and part numbers with records. 1.2 Interpreting inventory logs and requisition forms. 1.3 Documenting discrepancies such as shortages or overages. 1.4 Using inventory management systems 1.5 Understanding material requirements from job orders. 1.6 Assessing material conditions, including shelf life or degradation.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
2. Collect additive manufacturing materials from inventory*	2.1 Feedstock logged based on inventory records. 2.2 Additive manufacturing materials from inventory transferred to designated workshops.	**SCIENCE** 2.1 Proper handling of sensitive materials. **TECHNOLOGY** 2.1 Retrieval of additive manufacturing materials using management systems **COMMUNICATION** 2.1 Inventory process 2.2 Inventory forms	2.1 Handling additive manufacturing materials. 2.2 Maintaining proper traceability of collected materials. 2.3 Using appropriate Personal Protective Equipment (PPE) 2.4 Organizing materials during transfer to the build environment.

RANGE OF VARIABLES

VARIABLE	RANGE
1. Feedstock	May include: 1.1 Thermoplastic Filament 1.2 Photosensitive Resin
2. Job Order	May include: 2.1 Design Files 2.2 Materials 2.3 Quantity 2.4 Print Settings 2.5 Deadline 2.6 Post-Processing Requirements 2.7 Cost Estimate
3. Quantity of Material	May include: 3.1 Print Volume 3.2 Material Waste
4. Quality of Material	May include: 4.1 Mechanical Properties 4.2 Printability

EVIDENCE GUIDE

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Checked the inventory of additive manufacturing materials. 1.2 Collected additive manufacturing materials from the inventory.
2. Resource Implications	The following resources should be provided: 2.1 Tools, materials and equipment appropriate for the unit of competency 2.2 Workplace environment appropriate for the unit of competency
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Interview 3.2 Demonstration with Questioning 3.3 Observation with Questioning 3.4 Written Examination
4. Context of Assessment	4.1 Competency may be assessed in the actual workplace or at the designated TESDA Accredited Assessment Center.

UNIT OF COMPETENCY : **SET-UP ADDITIVE MANUFACTURING EQUIPMENT**

UNIT CODE : **ADM313302**

UNIT DESCRIPTOR : This unit covers the skills, knowledge, and attitudes required to set up (additive manufacturing) equipment in preparation for production. It includes preparing the build environment, configuring the machine interface, loading additive manufacturing materials, and verifying process readiness in accordance with job order specifications and additive manufacturing process requirements.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Prepare build environment*	1.1 ***Build plate*** is prepared in accordance with the ***additive manufacturing process*** requirement. 1.2 ***Basic machine calibrations*** are made on the 3D printer components as necessary. 1.3 ***Machine environment*** is checked in accordance with the additive manufacturing process requirements. 1.4 ***Print file*** is made ready in accordance with the additive manufacturing process	**SCIENCE** 1.1 Build environment 1.2 Printing environment **TECHNOLOGY** 1.1 Machine interface setup 1.2 Upload of print files **ENGINEERING** 1.1 Functions of key machine components 1.2 Machine operation principles 1.3 Machine user interface **MATHEMATICS** 1.1 3D coordinate system (X, Y, Z) **ENVIRONMENT** 1.1 Environmental conditions (temperature, humidity) for optimal printing.	1.1 Interpreting print files, verifying part orientation, and ensuring machine readiness. 1.2 Setting up the machine interface 1.3 loading print files correctly. 1.4 Preparing the build plate 1.5 Uploading print files in the machine interface. 1.6 Applying correct calibration techniques for software and mechanical

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
2. Load additive manufacturing material *	2.1 ***Machine setup*** is verified based on ***types of material***. 2.2 The additive manufacturing feedstock is loaded into the designated equipment based on the job order.	**ENGINEERING** 2.1 Machine user interface **ENVIRONMENT** 2.1 Proper material handling	2.1 Identifying the correct type and condition of additive manufacturing materials 2.2 Loading additive manufacturing materials correctly 2.3 Following proper loading procedures 2.4 Verifying material batch numbers and amounts

RANGE OF VARIABLES

VARIABLE	RANGE
1. Build plate	May include: 1.1 Type of build plate 1.1.1 Heated bed 1.1.2 Removable magnetic plate 1.1.3 Glass 1.2 Build plate adhesion for specific material 1.2.1 High temperature adhesive 1.2.2 General purpose adhesive 1.2.3 Polyetherimide (PEI) sheet 1.3 Build plate cleanliness 1.3.1 Dust free 1.3.2 Free from material residue 1.3.3 Oil free
2. Additive Manufacturing Process	May include: 2.1 Material Extrusion (MEx) 2.2 VAT Photopolymerization (VPP)
3. Basic Machine Calibrations	May include: 3.1 Bed level 3.2 Machine level 3.3 Layer height/Z-height distance 3.4 Extrusion consistency
4. Machine Environment	May include: 4.1 Nozzle Temperature 4.2 Bed Temperature 4.3 Chamber Temperature 4.4 Humidity
5. Print File	May include: 5.1 geometric code (.gcode) 5.2 3D Manufacturing Format (.3MF) 5.3 Color-dependent Plot Style Table (.ctb)
6. Machine setup	May include: 6.1 Nozzle/extruder temperature 6.2 Type of Nozzle 6.3 Type of Vat
7. Types of material	May include: 3.1 Plastic Filaments 3.2 Photopolymer Resins

EVIDENCE GUIDE

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Prepared the build environment in accordance with the type of machine. 1.2 Verified the correct print file(s) and file compatibility. Based on the job order. 1.3 Loaded the additive manufacturing material on the machine as specified on the job order
2. Resource Implications	The following resources should be provided: 2.1 Additive manufacturing equipment representative of workplace processes 2.2 Range of additive manufacturing materials and consumables plus preparation tools 2.3 Tools and measurement devices (calipers, feeler gauge). 2.4 Computer with slicing/printing software.
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Interview 3.2 Demonstration with Questioning 3.3 Observation with Questioning 3.4 Written Examination
4. Context of Assessment	4.1 Competency may be assessed in the actual workplace or at the designated TESDA Accredited Assessment Center.

UNIT OF COMPETENCY : **OPERATE ADDITIVE MANUFACTURING EQUIPMENT**

UNIT CODE : **ADM313303**

UNIT DESCRIPTOR : This unit covers the knowledge, skills, and attitudes required to perform 3D printing operations, monitor ongoing processes, and safely remove printed parts in accordance with additive manufacturing standards and procedures.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Perform 3D printing job*	1.1 ***File*** compatibility is checked at the start of the process in accordance with the additive manufacturing process. 1.2 The ***printing job*** is initiated from the machine interface in accordance with the additive manufacturing process.	**ENGINEERING** 1.1 Machine operation principles 1.2 Additive manufacturing parameters affecting print quality **MATHEMATICS** 1.1 Print time estimation 1.2 Material usage estimation **COMMUNICATION** 1.1 Print job instructions 1.2 Job progress documentation	1.1 Operating the additive manufacturing machine controls to start, pause, and stop jobs 1.2 Confirming job setup consistency with job order specifications 1.3 Applying the additive manufacturing process, additive manufacturing parameters for different materials and technologies 1.4 Executing printing operations safely and verifying initial job success

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
2. Monitor printing process*	2.1 The ***printing process*** is monitored for common failures in accordance with additive manufacturing protocols. 2.2 Any ***print failures*** or ***machine errors*** are addressed immediately.	**SCIENCE** 2.1 Thermal processes in material fusion 2.2 Chemical processes in material fusion **ENGINEERING** 2.1 Common print failures such as warping, layer shifting, and under-extrusion **MATHEMATICS** 2.1 Printing time estimation 2.2 Material consumption **COMMUNICATION** 2.1 Report preparation 2.2 Job status report **ENVIRONMENT** 2.1 Safe material handling 2.2 Cooling requirements for parts	2.1 Observing and detecting print issues such as warping, layer shifting, or material additive manufacturing 2.2 Diagnosing common defects during the build process 2.3 Removing printed parts safely without damaging the product or the build plate 2.4 Monitoring long-duration print jobs with focus and patience to ensure quality control

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
3. Remove printed part*	3.1 The finished part is carefully detached from the ***build plate.*** 3.2 The ***work area*** is kept clean and free from ***leftover materials.***	**SCIENCE** 3.1 Material behavior during and after printing 3.2 Thermal contraction effects on part release **TECHNOLOGY** 3.1 Hand tools for part removal 3.2 Machine-specific removal procedures **ENGINEERING** 3.1 Part adhesion methods and safe detachment techniques 3.2 Mechanical risks during part removal **ENVIRONMENT** 3.1 Workplace safety standards during part removal 3.2 Proper collection and disposal of leftover material	3.1 Detaching printed parts from the build plate without causing damage. 3.2 Anticipating material behavior (brittleness or flexibility) during part removal. 3.3 Using appropriate hand tools or equipment for safe part removal.

RANGE OF VARIABLES

VARIABLE	RANGE
1. File	May include: 1.1 Ultimaker Format Package (.ufp) 1.2 3D Manufacturing Format (.3mf) 1.3 Geometric Code (.gcode) 1.4 Chitubox Format (.ctb) 1.5 Additive Manufacturing Format (.amf)
2. Printing job	May include: 2.1 Loading print files 2.2 Verifying job order specifications
3. Printing process	May include: 3.1 Fused Filament Fabrication (FFF) 3.2 Stereolithography (SLA) 3.3 Masked Stereolithography (MSLA)
4. Print failures	May include: 4.1 Warping 4.2 Layer shifting 4.3 Stringing 4.4 Nozzle clogging
5. Machine errors	May include: 5.1 Thermal runaway 5.2 Axis misalignment 5.3 Calibration failure 5.4 Tangled filament 5.5 Filament runout 5.6 Resin runout 5.7 Wiper error
6. Build plate	May include: 6.1 Glass 6.2 Metal 6.3 Polyetherimide (PEI) sheet surfaces
7. Work area	May include: 7.1 Workstations 7.2 Storage areas
8. Leftover materials	May include: 8.1 Test prints 8.2 Support structures 8.3 Rafts 8.4 Purged filament 8.5 Excess liquid resin 8.6 Brims 8.7 Purge tower

EVIDENCE GUIDE

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Performed 3D printing jobs according to job order specifications. 1.2 Monitored the printing process and identified common failures such as warping, layer shifting, or under-extrusion. 1.3 Removed the printed part from the build plate without causing damage to the part or wear to the equipment.
2. Resource Implications	The following resources should be provided 2.1 Tools, materials and equipment appropriate for the unit of competency 2.2 Workplace environment appropriate for the unit of competency
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Interview 3.2 Demonstration with Questioning 3.3 Observation with Questioning 3.4 Written Examination
4. Context of Assessment	4.1 Competency may be assessed in the actual workplace or at the designated TESDA Accredited Assessment Center.

UNIT OF COMPETENCY : **PERFORM PRELIMINARY POST-PROCESSING OF 3D PRINTED OUTPUT**

UNIT CODE : **ADM313304**

UNIT DESCRIPTOR : This unit covers the knowledge, skills, and attitudes required to remove print supports safely and to perform appropriate washing and curing procedures to ensure finished additive manufacturing parts meet quality and safety standards.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Remove print supports*	1.1 Printed supports are removed in accordance with appropriate ***techniques.*** 1.2 Printed supports are removed in accordance with appropriate ***tools***	**SCIENCE** 1.1 Material behavior during preliminary post-processing **TECHNOLOGY** 1.1 Manual support removal tools 1.2 Automated support removal tools **ENGINEERING** 1.1 Support removal techniques without damaging part integrity **ENVIRONMENT** 1.1 Proper disposal of supports or any waste material	1.1 Using hand tools with manual dexterity to detach supports without damaging the part 1.2 Recognizing areas prone to surface or structural damage 1.3 Handling pliers, cutters, and other support-removal tools safely 1.4 Ensuring all supports are fully removed
2. Perform wash and cure procedure as appropriate*	2.1 ***Personal Protective Equipment (PPE)*** is used correctly in accordance with workplace safety procedures and manufacturer's guidelines. 2.2 3D printed part is washed using the correct ***cleaning agent*** as appropriate. 2.3 3D printed part is ***cured using Ultraviolet (UV) light*** as appropriate.	**SCIENCE** 2.1 Ultraviolet curing principles 2.2 Safe use of chemical agents **TECHNOLOGY** 2.1 Operation of wash stations 2.2 Operation of cure stations **ENVIRONMENT** 2.1 Proper disposal of chemicals (uncured resin, Isopropyl Alcohol)	2.1 Following the correct washing and curing procedures 2.2 Applying technical guidelines for solvents, curing times, and equipment settings 2.3 Handling solvents, ultraviolet light, and heat sources safely 2.4 Inspecting finished parts to verify proper curing and surface quality

RANGE OF VARIABLES

VARIABLE	RANGE
1. Techniques	May include: 1.1 Manual Techniques 1.1.1 Using side cutter 1.1.2 Using pliers 1.1.3 Using hands 1.1.4 Using rotary tool 1.2 Thermal techniques 1.2.1 Softening supports using controlled heat before removal 1.3 Solvent-based techniques 1.3.1 Dissolving supports using appropriate solvent solutions 1.3.2 Rinsing with 90% isopropyl alcohol to loosen fragile supports
2. Tools	May include: 2.1 Scrapers 2.2 Pliers 2.3 Cutters 2.4 Spatulas 2.5 Rotary Tool
3. Personal Protective Equipment (PPE)	May include: 3.1 Gloves 3.2 Safety goggles 3.3 Lab coat or apron 3.4 Face mask (at least N95)
4. Cleaning agent	May include: 4.1 Isopropyl alcohol (at least 90%) 4.2 Water
5. Cured using Ultraviolet (UV) light	May include: 5.1 Curing machine 5.2 UV light pen 5.3 UV light lamp 5.4 Any source of UV light

EVIDENCE GUIDE

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Removed print supports using appropriate tools and techniques without damaging the part. 1.2 Performed wash and cure procedure as appropriate.
2. Resource Implications	The following resources should be provided: 2.1 Tools, materials, and equipment appropriate for the unit of competency 2.2 Workplace environment appropriate for the unit of competency
3. Methods of Assessment	Competency in this unit may be assessed through 3.1 Demonstration with Questioning 3.2 Observation with Questioning 3.3 Written Examination
4. Context of Assessment	4.1 Competency may be assessed in the actual workplace or at the designated TESDA Accredited Assessment Center.

UNIT OF COMPETENCY : **PERFORM BASIC MAINTENANCE ON 3D PRINTERS**

UNIT CODE : **ADM313305**

UNIT DESCRIPTOR : This unit covers the knowledge, skills, and attitudes required to perform basic maintenance on 3D printers and to clean equipment and tools after operation in order to ensure proper functionality, extend service life, and maintain safe working conditions in additive manufacturing processes.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
1. Assess the machine for maintenance*	1.1 ***Parts*** are recognized if it has degraded due to wear and tear based on performance and manufacturer's specifications 1.2 ***Basic machine components*** are lubricated or replaced according to the maintenance schedule. 1.3 Test print output is produced based on the job order specifications. 1.4 Non-conformance are documented according to job order specifications.	**TECHNOLOGY** 1.1 Diagnostic tools for maintenance checks. 1.2 Software tools for monitoring machine performance. **ENGINEERING** 1.1 Wearable parts and their functions. 1.2 Maintenance schedules and procedures. 1.3 Measuring Instruments or equipment 1.4 Machine user interface 1.5 Machine operation principles **MATHEMATICS** 1.1 Maintenance planning based on operation hours. 1.2 Usage cycles of machine components. 1.3 3D Coordinate Systems (X,Y,Z) **COMMUNICATION** 1.1 Log of maintenance tasks. 1.2 Documentation of activities in digital systems.	1.1 Replacing worn out snap-in components 1.2 Following technical manuals and diagrams for maintenance tasks. 1.3 Conducting preventive maintenance such as cleaning and inspection. 1.4 Diagnosing print quality issues related to worn or dirty components. 1.5 Identify instruments or equipment requiring calibration 1.6 Complete calibration reports or data sheets. 1.7 Examine test print outputs based on defined quality parameters 1.8 Visual inspection techniques to identify print defects.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables	REQUIRED KNOWLEDGE	REQUIRED SKILLS
2. Maintain the equipment and tools used after the operation*	2.1 ***Cleaning tools and consumables*** are used appropriately in accordance with standard operating procedures. 2.2 All ***maintenance activities*** are documented in accordance with standard operating procedures.	**SCIENCE** 2.1 Chemical agents appropriate for Fused Deposition Modelling (FDM) and Stereolithography (SLA) 2.2 Methods of cleaning suitable for different additive manufacturing materials. **ENGINEERING** 2.1 Cleaning procedures for additive manufacturing equipment. 2.2 Tool care and handling during cleaning. **COMMUNICATION** 2.1 Documentation procedures of cleaning activities. 2.2 Readiness of equipment and tools for subsequent operations. **ENVIRONMENT** 2.1 Proper cleaning that will improve energy efficiency. 2.2 Cleaning to reduce waste and material loss.	2.1 Applying routine cleaning procedures consistently to extend equipment lifespan. 2.2 Documenting cleaning activities for operational traceability. 2.3 Proper handling of tools during cleaning

RANGE OF VARIABLES

VARIABLE	RANGE
1. Parts	May include: 1.1 Nozzles 1.1.1 Description 1.1.2 Clogging 1.1.3 Bore condition 1.1.4 External buildup 1.1.5 Threads and seating 1.2 Belts 1.2.1 Belt tension 1.2.2 Teeth condition 1.2.3 Alignment and tracking 1.2.4 Elasticity / stretching 1.3 Build Plates 1.3.1 Surface scratches 1.3.2 Flatness 1.3.3 Coating integrity 1.3.4 Adhesion quality 1.4 Rollers and bearings 1.4.1 Surface condition 1.4.2 Smoothness of operations 1.4.3 Alignment 1.4.4 Dust, debris, and corrosion 1.5 Resin vats 1.5.1 Surface condition 1.5.2 Tension and flatness of Release film 1.5.3 Release film transparency 1.5.4 Punctures and Tears
2. Basic machine components	May include: 2.1 Bearings and lead screws 2.2 Snap-in components 2.2.1 Build platform 2.2.2 Resin Tanks 2.2.3 Hot-end assembly
3. Cleaning Tools and Consumables	May include: 3.1 Cleaning tools 3.1.1 Resin filters and containers 3.1.2 Scrapers or spatulas 3.1.3 Steel brush 3.1.4 Plastic brush 3.1.5 Nozzle cleaning needle 3.2 Cleaning consumables 3.2.1 Lint-free pads and wipes 3.2.2 Isopropyl Alcohol (atleast 90%) 3.2.3 Glass cleaner 3.2.4 Nitrile Gloves 3.2.5 Water 3.2.6 Cleaning pads 3.2.7 Tissue/ Paper towel/ Table napkin 3.2.8 Dishwashing liquid

4. Maintenance Activities	May include: 4.1 List of activities conducted 4.2 List of observations if any 4.3 List of parts replaced if any 4.4 Log details (e.g. date, personnel, signature, remarks)

EVIDENCE GUIDE

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Performed preventive machine maintenance 1.2 Maintained the equipment and tools used after the operation. 1.3 Cleaned the equipment and tools used after the operation.
2. Resource Implications	The following resources should be provided: 2.1 Tools, materials and equipment appropriate for the unit of competency 2.2 Workplace environment appropriate for the unit of competency
3.Methods of Assessment	Competency in this unit may be assessed through: 3.1 Interview 3.2 Demonstration with Questioning 3.3 Observation with Questioning 3.4 Written Examination
4. Context of Assessment	4.1 Competency may be assessed in the actual workplace or at the designated TESDA Accredited Assessment Center.

GLOSSARY OF TERMS

Term	Definition
1. 3D Printing	A commonly used term for Additive Manufacturing.
2. Additive Manufacturing (AM)	A process of creating objects by adding material layer by layer from a 3D model.
3. Batch Production	The process of manufacturing multiple parts in one build cycle using AM equipment.
4. Build Plate	The surface or platform on which 3D printed objects are built.
5. Calibration	The process of adjusting and verifying AM equipment settings to ensure accuracy and precision.
6. Dimensional Accuracy	How close the printed object's dimensions are to the original CAD design.
7. G-code	A machine-readable code that provides instructions for positioning and controlling AM equipment.
8. Layer Thickness	The height of each deposited layer in an AM build, which affects resolution and quality.
9. Maintenance	Regular activities performed to keep AM equipment in proper working condition.
10. Material Feed System	The mechanism that supplies material (e.g., filament, resin, or powder) to an AM machine.
11. Mechanical Properties	Characteristics of a printed material, such as strength, flexibility, and toughness.
12. Post-Processing	Secondary operations performed after printing, such as cleaning, curing, support removal, or surface finishing.
13. Prototype	A preliminary version of a product used to test design and function before final production.
14. Range of Variables	The conditions, contexts, and resources under which performance is assessed in a Unit of Competency.
15. Slicing Software	Software that converts 3D models into layer-by-layer instructions (G-code) for AM machines.
16. Support Structures	Temporary printed material that supports overhanging features during the printing process.
17. Tolerance	The allowable deviation in the size, shape, or position of a manufactured object.
18. Troubleshooting	The process of identifying and resolving issues or malfunctions in AM processes or equipment.
19. Warping	A defect in 3D printing where parts curl or deform due to uneven cooling
20. Workplace Simulation	A training or assessment setup that mimics actual work conditions

GLOSSARY OF TERMS (Acronyms)

Acronym	Abbreviation
.3mf / .3MF	3D Manufacturing Format
.amf	Additive Manufacturing Format
.ctb	Color-dependent Plot Style Table / Chitubox Format
.gcode	Geometric Code
.stl	Standard Tessellation Language
.ufp	Ultimaker Format Package
AM	Additive Manufacturing
CAD	Computer-Aided Design
CS	Competency Standards
FDM	Fused Deposition Modeling
FFF	Fused Filament Fabrication
MEx	Material Extrusion
MSLA	Masked Stereolithography
OSH	Occupational Safety and Health
PBF	Powder Bed Fusion
PEI	Polyetherimide
PPE	Personal Protective Equipment
QMS	Quality Management System
RA	Republic Act
SLA	Stereolithography
SRT	Self-Regulation Theory
TESDA	Technical Education and Skills Development Authority
UV	Ultraviolet
VPP	VAT Photopolymerization

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