REPUBLIC OF KENYA

NATIONAL OCCUPATIONAL STANDARDS

FOR

CHEMICAL ENGINEERING TECHNICIAN

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LEVEL 6

TVET CDACC
P.O. BOX 15745-00100
NAIROBI

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FOREWORD

The provision of quality education and training is fundamental to the Government's overall strategy for social economic development. Quality education and training will contribute to achievement of Kenya's development blueprint and sustainable development goals.

Reforms in the education sector are necessary for the achievement of Kenya Vision 2030 and meeting the provisions of the Constitution of Kenya 2010. The education sector had to be aligned to the Constitution and this resulted to the formulation of the Policy Framework for Reforming Education and Training (Sessional Paper No. 4 of 2016). A key feature of this policy is the radical change in the design and delivery of the TVET training. This policy document requires that training in TVET be competency based, curriculum development be industry led, certification be based on demonstration of competence and mode of delivery allows for multiple entry and exit in TVET programmes.

These reforms demand that Industry takes a leading role in curriculum development to ensure the curriculum addresses its competence needs. It is against this background that this curriculum has been developed.

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It is my conviction that this curriculum will play a great role towards development of competent human resource for the Chemical engineering sector's growth and sustainable development.

PRINCIPAL SECRETARY, VOCATIONAL AND TECHNICAL TRAINING
MINISTRY OF EDUCATION

PREFACE

Kenya Vision 2030 aims to transform the country into a newly industrializing, "middle-income country providing a high-quality life to all its citizens by the year 2030". Kenya intends to create a globally competitive and adaptive human resource base to meet the requirements of a rapidly industrializing economy through life-long education and training. TVET has a responsibility of facilitating the process of inculcating knowledge, skills and attitudes necessary for catapulting the nation to a globally competitive country, hence the paradigm shift to embrace Competency Based Education and Training (CBET).

The Technical and Vocational Education and Training Act No. 29 of 2013 and Sessional Paper No. 4 of 2016 on Reforming Education and Training in Kenya, emphasized the need to reform curriculum development, assessment and certification. This called for a shift to CBET in order to address the mismatch between skills acquired through training and skills needed by industry as well as increase the global competitiveness of Kenyan labour force.

This Occupational Standard has been designed for competency-based training and has independent units of learning that allow the trainee flexibility in entry and exit.

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I am grateful to the Council members, Council Secretariat, Chemical Engineering SSAC, expert workers and all those who participated in the development of this curriculum.

Prof. CHARLES M. M. ONDIEKI, PhD, FIET (K), Con. EngTech.
CHAIRMAN, TVET CDACC

ACKNOWLEDGEMENT

This Occupational Standard has been designed for competency-based training and has independent units of learning that allow the trainee flexibility in entry and exit. In developing the OS, significant involvement and support was received from various organizations.

I recognize with appreciation the role of Chemical Engineering Sector Skills Advisory Committee (SSAC) members for their contribution to the development of this Occupational Standard (OS).

I also thank all stakeholders in the Chemical engineering sector for their valuable input and all those who participated in the process of developing this OS.

I am convinced that this OS will go a long way in ensuring that workers in Chemical engineering sector acquire competencies that will enable them to perform their work more efficiently.

CHAIRPERSON,
CHEMICAL ENGINEERING, SECTOR SKILL ADVISORY COMMITTEE (SSAC)

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ACRONYMNS

CBET	: Competency Based Education and Training
CDACC	: Curriculum Development Assessment and Certification Council
CUR	: Curriculum
DACUM	: Develop a Curriculum
EMCA	: Environmental Management and Conservation Act
KCSE	: Kenya Certificate of Secondary Education
KNQA	: Kenya National Qualifications Authority
MoEST	: Ministry of Education Science and Technology
NGO	: Non-Governmental Organization
NOS	: National Occupation Standard
OS	: Occupational Standard
OSHA	: Occupation Safety and Health Act
PPE	: Personal Protective Equipment
RPL	: Recognition of Prior Learning
SSAC	: Sector Skills Advisory Committee
TVETA	: Technical and Vocational Education and Training Authority

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KEY TO UNIT CODE

ENG/OS/CE/BC/01/6

Industry or sector
Occupational Standards
Occupational area

Type of competency
Competency number

Competency level

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OVERVIEW

Chemical Engineering Technician Level 6 qualification consists of competencies that an individual must achieve to enable him/her to offer chemical engineering technician services comprising of maintaining environmental health and safety (EHS) standards, performing process quality control, optimizationing, processing raw materials, operating process equipment, maintaining production line equipment and auditing production process.

The units of competency comprising Chemical Engineering Technician Level 6 qualification include the following:

BASIC UNITS OF COMPETENCY

Unit of Competency Code	Unit of Competency Title
ENG/OS/CE/BC/1/6	Demonstrate communication Skills
ENG/OS/CE/BC/2/6	Demonstrate digital literacy
ENG/OS/CE/BC/3/6	Demonstrate numeracy
ENG/OS/CE/BC/4/6	Demonstrate entrepreneurship
ENG/OS/CE/BC/5/6	Demonstrate environmental Literacy
ENG/OS/CE/BC/6/6	Demonstrate employability skills
ENG/OS/CE/BC/7/6	Demonstrate occupational Safety and Health

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COMMON UNITS OF COMPETENCY

Unit of Competency Code	Unit of Competency Title
ENG/OS/CE//CC/01/6	Apply Mathematics
ENG/OS/CE/CC/02/6	Interpret Technical Drawing
ENG/OS/CE/CC/02/6	Apply Chemical science
ENG/OS/CE/CC/04/6	Apply Electrical science
ENG/OS/CE/CC/05/6	Apply mechanical science
ENG/OS/CE/CC/06/6	Apply Workshop technology practices

CORE UNITS OF COMPETENCY

Unit of Competency Code	Unit of Competency Title
ENG/OS/CE/CR/1/6	Maintain environmental health and safety (EHS) standards
ENG/OS/CE/CR/2/6	Perform process quality control
ENG/OS/CE/CR/3/6	Perform Process control and Optimization

ENG/OS/CE/CR/4/6	Prepare process raw materials
ENG/OS/CE/CR/5/6	Maintain Production line equipment
ENG/OS/CE/CR/6/6	Audit production process

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BASIC UNITS OF COMPETENCY

DEMONSTRATE COMMUNICATION SKILLS

UNIT CODE: ENG/OS/CE/BC/1/6

UNIT DESCRIPTION

This unit covers the competencies required in meeting communication needs of clients and colleagues; developing, establishing, maintaining communication pathways and strategies. It also covers competencies for conducting interviews, facilitating group discussion and representing the organization in various forums.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make the workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Meet communication needs of clients and colleagues.	1.1 Specific communication needs of clients and colleagues are identified and met. 1.2 Different approaches are used to meet communication needs of clients and colleagues. 1.3 Conflict is addressed promptly and in a timely way and in a manner which does not compromise the standing of the organization.
2. Develop communication strategies.	2.1 Strategies for effective internal and external dissemination of information are developed to meet the organization's requirements. 2.2 Special communication needs are considered in developing strategies to avoid discrimination in the workplace. 2.3 Communication ***strategies*** are analysed, evaluated and revised where necessary to make sure they are effective.
3. Establish and maintain communication pathways.	3.1 Pathways of communication are established to meet requirements of organization and workforce. 3.2 Pathways are maintained and reviewed to ensure personnel are informed of relevant information.
4. Promote use of communication strategies.	4.1 Information is provided to all areas of the organization to facilitate implementation of the strategy. 4.2 Effective communication techniques are articulated and modelled to the workforce.

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ELEMENT These describe the key outcomes which make the workplace function.	PERFORMANCE CRITERIA These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
	4.3 Personnel are given guidance about adapting communication strategies to suit a range of contexts.
5. Conduct interview.	5.1 A range of appropriate communication strategies are employed in ***interview situations.*** 5.2 Records of interviews are made and maintained in accordance with organizational procedures. 5.3 Effective questioning, listening and nonverbal communication techniques are used to ensure that the required message is communicated.
6. Facilitate group discussion.	6.1 Mechanisms which enhance ***effective group interaction*** is defined and implemented. 6.2 Strategies which encourage all group members to participate are used routinely. 6.3 Objectives and agenda for meetings and discussions are routinely set and followed. 6.4 Relevant information is provided to the group to facilitate outcomes. 6.5 Evaluation of group communication strategies is undertaken to promote participation of all parties. 6.6 Specific communication needs of individuals are identified and addressed.
7. Represent the organization.	7.1 When participating in internal or external forums, presentation is relevant, appropriately researched and presented in a manner to promote the organization. 7.2 Presentation is clear and sequential and delivered within a predetermined time. 7.3 Appropriate media is utilized to enhance presentation. 7.4 Differences in views are respected. 7.5 Written communication is consistent with organizational standards. 7.6 Inquiries are responded to in a manner consistent with organizational standards.

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RANGE

This section provides work environment and conditions to which the performance criteria apply. It allows for different work environment and situations that will affect performance.

Variable	Range
1. Communication strategies include but not limited to:	1.1 Language switch 1.2 Comprehension check 1.3 Repetition 1.4 Asking for confirmation. 1.5 Paraphrase 1.6 Clarification request. 1.7 Translation 1.8 Restructuring 1.9 Approximation 1.10 Generalization.
2. Effective group interaction includes but is not limited to:	2.1 Identifying and evaluating what is occurring within an interaction in a non-judgmental way. 2.2 Using active listening. 2.3 Making a decision about appropriate words, behaviour. 2.4 Putting together a response which is culturally appropriate. 2.5 Expressing an individual perspective. 2.6 Expressing own philosophy, ideology and background and exploring its impact with relevance to communication.
3. Situations include but not limited to:	3.1 Establishing rapport. 3.2 Eliciting facts and information. 3.3 Facilitating resolution of issues. 3.4 Developing action plans. 3.5 Diffusing potentially difficult situations.

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REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit of competency.

Required Skills

The individual needs to demonstrate the following skills:

- Effective communication.
- Active listening.
- Giving/receiving feedback.
- Interpretation of information.
- Role boundaries setting.
- Negotiation.

- Establishing empathy.
- Openness and flexibility in communication.
- Communication skills required to fulfil job roles as specified by the organization.
- Writing communications strategy.
- Applying key elements of communications strategy.

Required Knowledge

The individual needs to demonstrate knowledge of:

- Communication process.
- Dynamics of groups and different styles of group leadership.
- Communication skills relevant to client groups.
- Flexibility in communication.
- Communication skills relevant to client groups.
- Key elements of communications strategy.

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical aspects of Competency	Assessment requires evidence that the learner: 1.1 Developed communication strategies to meet the organization requirements and applied in the workplace 1.2 Established and maintained communication pathways for effective communication in the workplace 1.3 Used communication strategies involving exchanges of complex oral information
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 Direct Observation/Demonstration with Oral Questioning 3.2 Written Examination
4. Context of Assessment	Competency may be assessed individually in the actual workplace or through accredited institution
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

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DEMONSTRATE DIGITAL LITERACY

UNIT CODE: ENG/OS/CE/BC/2/6

UNIT DESCRIPTION

This unit covers the competencies required to effectively using digital devices such as smartphones, tablets, laptops and desktop PCs. It entails identifying and using digital devices such as smartphones, tablets, laptops and desktop PCs for purposes of communication, work performance and management at the work place.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace functions.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Identify appropriate computer software and hardware.	1.1 Concepts of ICT are determined in accordance with computer equipment. 1.2 Classifications of computers are determined in accordance with manufacturer's specification. 1.3 ***Appropriate computer softwares*** are identified according to manufacturer's specification. 1.4 ***Appropriate computer hardware*** are identified according to manufacturer's specification. 1.5 Functions and commands of operating system are determined in accordance with manufacturer's specification.
2. Apply security measures to data, hardware, and software in automated environment.	2.1 ***Data security and privacy are classified*** in accordance with the prevailing technology. 2.2 ***Security threats*** are identified ***and control measures*** are applied in accordance with laws governing protection of ICT. 2.3 Computer threats and crimes are detected. 2.4 Protection against computer crimes is undertaken in accordance with laws governing protection of ICT.
3. Apply computer software in solving tasks	3.1 ***Word processing concepts*** are applied in resolving workplace tasks, report writing and documentation. 3.2 ***Word processing utilities*** are applied in accordance with workplace procedures. 3.3 Worksheet layout is prepared in accordance with work procedures. 3.4 Worksheets are built and data manipulated in the worksheets in accordance with workplace procedures. 3.5 Continuous data manipulated on worksheet is undertaken in accordance with work requirements

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ELEMENT These describe the key outcomes which make up workplace functions.	PERFORMANCE CRITERIA These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
	3.6 Database design and manipulation is undertaken in accordance with office procedures. 3.7 Data sorting, indexing, storage, retrieval and security is provided in accordance with workplace procedures.
4. Apply internet and email in communication at workplace.	4.1 Electronic mail addresses are opened and applied in workplace communication in accordance with office policy. 4.2 Office internet functions are defined and executed in accordance with office procedures. 4.3 ***Network configuration*** is determined in accordance with office operations procedures. 4.4 Official World Wide Web is installed and managed according to workplace procedures.
5. Apply Desktop publishing in official assignments.	5.1 Desktop publishing functions and tools are identified in accordance with manufactures specifications. 5.2 Desktop publishing tools are developed in accordance with work requirements. 5.3 Desktop publishing tools are applied in accordance with workplace requirements. 5.4 Typeset work is enhanced in accordance with workplace standards.
6. Prepare presentation packages.	6.1 Types of presentation packages are identified in accordance with office requirements. 6.2 Slides are created and formulated in accordance with workplace procedures. 6.3 Slides are edited and run in accordance with work procedures. 6.4 Slides and handouts are printed according to work requirements.

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RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variable	Range
1. Appropriate computer software include but not limited to:	A collection of instructions or computer tools that enable the user to interact with a computer, its hardware, or perform tasks.
2. Appropriate computer hardware include but not	Collection of physical parts of a computer system such as; 1.1 Computer case, monitor, keyboard, and mouse

Variable	Range
limited to:	1.2 All the parts inside the computer case, such as the hard disk drive, motherboard and video card.
3. Data security and privacy include but not limited to:	3.1 Confidentiality of data 3.2 Cloud computing 3.3 Integrity-but-curious data surfing
4. Security and control measures include but not limited to:	4.1 Counter measures against cyber terrorism 4.2 Risk reduction 4.3 Cyber threat issues 4.4 Risk management 4.5 Pass-wording.
5. Security threats may include but not limited to:	5.1 Cyber terrorism 5.2 Hacking
6. Word processing concepts include but not limited to:	Using a special program to create, edit and print documents.
7. Network configuration include but not limited to:	Organizing and maintaining information on the components of a computer network.

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REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit of competency.

Required Skills

The individual needs to demonstrate the following skills:

- Analytical skills.
- Interpretation.
- Typing.
- Communication.
- Computing (applying fundamental operations such as addition, subtraction, division and multiplication).
- Using a calculator.
- Basic ICT skills.

Required Knowledge

The individual needs to demonstrate knowledge of:

- Software concept.
- Functions of computer software and hardware.
- Data security and privacy.
- Computer security threats and control measures.
- Technology underlying cyber-attacks and networks.
- Cyber terrorism.

- Computer crimes.
- Detection and protection of computer crimes.
- Laws governing protection of ICT.
- Word processing;

✓ Functions and concepts of word processing.
✓ Documents and tables creation and manipulations.
✓ Mail merging.
✓ Word processing utilities.
✓ Spread sheets;
✓ Meaning, formulae, function and charts, uses and layout.
✓ Data formulation, manipulation and application to cells.
✓ Database;
✓ Database design, data manipulation, sorting, indexing, storage retrieval and security
✓ Desktop publishing;
✓ Designing and developing desktop publishing tools.
✓ Manipulation of desktop publishing tools.
✓ Enhancement of typeset work and printing documents.
✓ Presentation Packages;
✓ Types of presentation packages.
✓ Creating, formulating, running, editing, printing and presenting slides and hand-outs
✓ Networking and Internet;
✓ Computer networking and internet.
✓ Electronic mail and World Wide Web.
✓ Emerging trends and issues in ICT;
✓ Identify and integrate emerging trends and issues in ICT.
✓ Challenges posed by emerging trends and issues.

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EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance Criteria, required skills and knowledge and range.

1. Critical Aspects of Competency.	Assessment requires evidence that the learner: 1.1 Identified and controlled security threats. 1.2 Detected and protected computer crimes. 1.3 Applied word processing in office tasks. 1.4 Designed, prepared work sheet and applied data to the cells in accordance to workplace procedures. 1.5 Opened electronic mail for office communication as per workplace procedure. 1.6 Installed internet and World Wide Web for office tasks in accordance with office procedures. 1.7 Integrated emerging issues in computer ICT applications. 1.8 Applied laws governing protection of ICT.

2. Resource Implications.	2.1 Tablets. 2.2 Laptops. 2.3 Desktop PCs. 2.4 Desktop computer. 2.5 Calculator. 2.6 Internet. 2.7 Smart phone. 2.8 Operations Manuals.
3. Methods of Assessment.	Competency may be assessed through: 3.1 Written Test. 3.2 Demonstration. 3.3 Practical assignment. 3.4 Interview/Oral Questioning. 3.5 Demonstration.
4. Context of Assessment.	Competency may be assessed in an off and on the job setting.
5. Guidance information for assessment.	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

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DEMONSTRATE ENTREPRENEURIAL SKILLS

UNIT CODE: ENG/OS/CE/BC/3/6

UNIT DESCRPTION

This unit covers the outcomes required to build and develop the enterprise to be more competitive within a changing business environment, specifically responding to consumer demands while maintaining product quality and accessibility, building a customer base and employee motivation.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT	PERFORMANCE CRITERIA
1. Develop business Innovative strategies.	1.1 Business innovation strategies are determined in accordance with the organization strategies. 1.2 Business innovation strategies are implemented for the purpose of business growth. 1.3 Track record and normative capability profile of enterprise and similar businesses are reviewed and considered in setting ***strategic directions***. 1.4 Strengths, weaknesses, opportunities and threats are considered when developing new ideas, approaches, goals and directions. 1.5 Decisions about enterprise strategies/directions are made after careful consideration of all relevant information. 1.6 ***Business/corporate plan*** is developed that sets out tactics, resource implications, timeframes, production and sales target.
2. Develop new products/ markets.	2.1 Alternative product/service offerings are canvassed and studied for feasibility. 2.2 Potential and new sources/sellers of supplies and raw materials are identified and canvassed. 2.3 Target markets and buyers are identified and surveyed as to their preferences and brand loyalties.
3. Expand customers and product lines	3.1 Enterprise is built up and sustained through responsiveness to market demands and the regulatory environment. 3.2 Competitive advantage of existing products and services is maintained/enhanced through responsive advocacies and strategies. 3.3 Constant listening to stakeholder/client feedback is ensured to maintain loyal client base.
4. Motivate staff/workers.	4.1 Regular dialogue is established and maintained in all

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ELEMENT	PERFORMANCE CRITERIA
	levels and relevant sections of the enterprise. 4.2 Flow of communications in both directions is encouraged. 4.3 Helpful mechanisms and benefits are implemented. 4.4 Issues/problems are proactively resolved through win-win solutions wherever practicable.
5. Expand employed capital base.	5.1 Capital employed in business is continuously reviewed as per the strategic plan. 5.2 Business share holdings are reviewed in accordance with the type of business. 5.3 Capital employed is expanded according to organization procedures. 5.4 Types of shares are determined according to strategic plan. 5.5 Shares diversification process is undertaken as per office procedures. 5.6 Role of shareholders is determined and implemented in accordance organization procedures.
6. Undertake county/ regional business expansion.	6.1 Regions for expansion are continuously reviewed in accordance with strategic plan and company's expansion plan. 6.2 County business regulations are reviewed and adhered to in accordance with set procedures. 6.3 Regional laws and regulations are adhered to in accordance with set procedures. 6.4 County/regional business expansion is undertaken in accordance with organization's growth/ expansion plan.

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RANGE

This section provides work environment and conditions to which the performance criteria apply. It allows for different work environment and situations that will affect performance.

Variable	Range
1. Strategic directions include but not limited to:	1.1 Business continuity and succession 1.2 Resource access security. 1.3 Core competencies development. 1.4 New developments e.g. technological change, new products.
2. Business/Corporate plan include but not limited to:	2.1 Action steps and responsibilities of departments and individual workers. 2.2 Resource requirements and budget.

Variable	Range
	2.3 Tactics and strategies to achieve objectives.
3. Helpful mechanisms include but not limited to:	3.1 Wage and non-wage benefits. 3.2 Employee awards and recognition systems. 3.3 Employee rights and welfare policies. 3.4 Full-disclosure/transparency policies.

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit of competency.

Required Skills

The individual needs to demonstrate the following skills:

- Assessing a range of alternative products and strategies.
- Critically analyzing information, summarizing and making sense of previous and current market trends.
- Identifying changing consumer preferences and demographics.
- Thinking "outside the box".
- Ensuring quality consistency.
- Reducing lead time to product/service delivery.
- Managing operations/ production.
- Using formal problem-solving procedures, e. g., root-cause analysis, six sigma.
- Communication skills.
- Applying motivational principles, e. g., positive stroking, and behavior modification.
- Assessing a range of alternatives rather than choosing the easiest option.
- Achieving ownership and credibility for the enterprise vision.
- Critically analyzing information, summarizing and making sense of previous and current market trends.
- Developing solutions and practical strategies which are "outside the box".

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Required Knowledge

The individual needs to demonstrate knowledge of:

- Features and benefits of common operational practices, e. g., continuous improvement (kaizen), waste elimination.
- Conflict resolution.
- Health, safety and environment (HSE) principles and requirements.
- Public-relations strategies.
- Basic cost-benefit analysis.
- Basic financial management.
- Business strategic planning.
- Impact of change on individuals, groups and industries.
- Employee assistance.

- Government and regulatory processes.
- Local and international market trends.
- Product promotion strategies.
- Mechanisms in the enterprise.
- Market and feasibility studies.
- Local and global supply chains business models and strategies.
- Government and regulatory processes
- Local and international business environment.
- Concepts of change management.
- Relevant developments in other industries.
- Capital employed.
- Regional/ County business expansion.
- Innovation in business.

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical Aspects of Competency	Assessment requires evidence that the learner: 1.1 Demonstrated ability to maintain a profitable and stable enterprise as shown by stakeholder feedback, employee testimonies and company financial statements 1.2 Demonstrated ability to conceptualize and plan a micro/small enterprise 1.3 Demonstrated ability to manage/operate a micro/small-scale business 1.4 Demonstrated basic marketing skills
2. Resource Implications.	The following resources should be provided: • Interview guide for entrepreneurs. • Enterprise workers and third parties. • Materials and location relevant to the proposed activity and tasks.
3. Methods of Assessment.	• Case problems. • Interview. • Portfolio. • Third part reports.
4. Context of Assessment.	• Competency may be assessed in workplace or in a simulated workplace setting. • Assessment shall be observed while tasks are being undertaken whether individually or in-group.
5. Guidance information for assessment.	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

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DEMONSTRATE EMPLOYABILITY SKILLS

UNIT CODE: ENG/OS/CE/BC/4/6

UNIT DESCRIPTON

This unit covers competencies required to demonstrate employability skills. It involves competencies for exuding self-awareness and dealing with everyday life challenges; demonstrating critical safe work habits and leading a workplace team; planning and organizing work activities; applying learning, creativity and innovativeness in workplace functions; pursuing professional growth and managing time effectively in the workplace.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Develop self-awareness and understanding of every day demands and challenges in the workplace.	1.1 Personal vision, mission and goals are formulated based on potential and in relation to organization objectives. 1.2 Emotions are managed as per workplace requirements. 1.3 Thoughts, feelings and beliefs are expressed in direct, honest and appropriate ways. 1.4 Feelings are shared with others according to personal issues for healthy relations. 1.5 Individual performance is evaluated and monitored according to the agreed targets. 1.6 Assertiveness is developed and maintained based on the requirements of the job. 1.7 Own ideas and visions that generates excitement, enthusiasm and commitment are articulated. 1.8 Accountability and responsibility for own actions are demonstrated. 1.9 Self-esteem and a positive self-image are developed and maintained.

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ELEMENT These describe the key outcomes which make up workplace function.	PERFORMANCE CRITERIA These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
2. Demonstrate critical safe work habits for employees in the workplace.	2.1 Stress is managed at the workplace in accordance with workplace procedures. 2.2 Punctuality and time consciousness is demonstrated in line workplace policy. 2.3 Personal objectives are integrated with organization goals in accordance with organization's strategic plan. 2.4 Resources are effectively utilized in accordance with workplace policy. 2.5 Work priorities are set and met in according to workplace procedures. 2.6 Leisure time is recognized and used productively in line with organization policy. 2.7 Abstinence from drug and substance abuse is demonstrated as per workplace policy. 2.8 Awareness of HIV and AIDS is demonstrated in line with workplace requirements. 2.9 Safety consciousness is demonstrated in the workplace based on organization safety policy. 2.10 Emerging issues are dealt with in accordance with organization policy.
3. Lead a workplace team.	3.1 Role and objectives of the team are determined in accordance workplace policy. 3.2 Team parameters and relationships are identified according to set rules and regulations. 3.3 Individual responsibilities are identified in accordance with work procedures. 3.4 Effective and appropriate forms of communication in a team are established according to office policy. 3.5 Business communication is carried out as per workplace place policy and requirements of the job. 3.6 Team activities are complemented in accordance with office procedures. 3.7 Team building activities are planned for in line with organization policy. 3.8 Conflicts are resolved between team members in line with organization rules and regulations. 3.9 ***Gender mainstreaming*** is undertaken in accordance

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ELEMENT These describe the key outcomes which make up workplace function.	PERFORMANCE CRITERIA These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
	with set regulations. 3.10 Human rights are adhered to in accordance with existing protocol. 3.11 Healthy relationships are developed and maintained for harmonious co-existence in line with workplace.
4. Plan and organize work.	4.1 Work schedules are developed for accomplishing given tasks within the set time lines and based on workplace policy. 4.2 Time is managed achieve workplace set goals and objectives. 4.3 Clear project goals and deliverables are established according to company set policies and regulations. 4.4 Resources are mobilized, allocated and utilized to meet project goals and deliverables. 4.5 Work activities are monitored and evaluated in line with organization procedures. 4.6 Situations that require decision making are identified within the work place and decision made in accordance with workplace policy. 4.7 Steps required in making effective decisions are applied within the workplace. 4.8 Problems arising in the course of working are identified and solved or reported according the workplace policies and procedures. 4.9 Values required in problem solving process are demonstrated at the work place. 4.10 Situations within the workplace that require negotiation identified and negotiations done to create win-win situations. 4.11 Negotiation techniques are developed and applied at workplace to meet clientele's satisfaction and organizations' objectives.
5. Maintain professional growth and development in the workplace.	5.1 Personal training needs are assessed and identified in line with the requirements of the job. 5.2 ***Training and career opportunities*** are identified and availed based on job requirements. 5.3 Resources for training are mobilized and allocated

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ELEMENT These describe the key outcomes which make up workplace function.	PERFORMANCE CRITERIA These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
	based organizations skills needs. 5.4 Licensees and certifications relevant to job and career are obtained and renewed. 5.5 Personal growth is pursued towards improving the qualifications set for the profession. 5.6 Work priorities and commitments are managed based on requirement of the job and workplace policy. 5.7 Recognitions are sought as proof of career advancement in line with professional requirements.
6. Demonstrate learning, creativity and innovativeness in the workplace	6.1 Time and effort is invested in learning new skills based job requirements. 6.2 Willingness to learn in different context is demonstrated based on available learning opportunities arising in the workplace. 6.3 Learning opportunities are sought and allocated based on job requirement and in line with organization policy. 6.4 Application of learning is demonstrated in both technical and non-technical aspects based on requirements of the job. 6.5 Application of a range of basic IT skills is demonstrated based on requirements of the job. 6.6 Awareness of Occupational Health and Safety procedures are demonstrated in use of technology in the workplace. 6.7 Initiative is taken to create more effective and efficient processes and procedures in line with workplace policy. 6.8 New systems are developed and maintained in accordance with the requirements of the job. 6.9 Opportunities that are not obvious are identified and exploited in line with organization objectives. 6.10 Opportunities for performance improvement are identified proactively in area of work. 6.11 Awareness of personal role in workplace innovation is demonstrated.

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RANGE

This section provides work environment and conditions to which the performance criteria apply. It allows for different work environment and situations that will affect performance.

Range	Variable
1. Drug and substance abuse includes but not limited to:	Commonly abused 1.1 Alcohol 1.2 Tobacco 1.3 Miraa 1.4 Over-the-counter drugs. 1.5 Cocaine 1.6 Bhang 1.7 Glue.
2. Feedback includes but not limited to:	2.1 Verbal. 2.2 Written 2.3 Informal 2.4 Formal.
3. Clients includes but not limited to:	3.1 New clients 3.2 Existing clients. 3.3 Internal clients 3.4 External clients.
4. Relationships includes but not limited to:	4.1 Man/Woman 4.2 Trainer/trainee. 4.3 Employee/employer 4.4 Client/service provider 4.5 Husband/wife 4.6 Boy/girl 4.7 Parent/child 4.8 Sibling relationships.
5. Communication methods include but not limited to:	5.1 Written 5.2 Talk/presentation. 5.3 Video 5.4 Audio 5.5 Graphical. 5.6 Modelling.
6. Team includes but not limited to:	5.7 Small work group. 5.8 Staff in a section/department. 5.9 Inter-agency group.
7. Personal growth includes but not limited to:	7.1 Growth in the job 7.2 Career mobility. 7.3 Gains and exposure the job gives. 7.4 Net workings. 7.5 Benefits that accrue to the individual as a result of

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Range	Variable
	noteworthy performance
8. Personal objectives include but not limited to:	8.1 Long term 8.2 Short term 8.3 Broad. 8.4 Specific.
9. Trainings and career opportunities include but not limited to	9.1 Participation in training programs; 9.2 Technical 9.3 Supervisory 9.4 Managerial 9.5 Continuing Education 9.6 Serving as Resource Persons in conferences and workshops
10. Resource include but not limited to:	10.1 Human. 10.2 Financial. 10.3 Technology 10.4 Hardware. 10.5 Software.
11. Innovation include but not limited to:	11.1 New ideas. 11.2 Original ideas. 11.3 Different ideas. 11.4 Methods/procedures. 11.5 Processes 11.6 New tools.
12. Emerging issues include but not limited to:	13. Terrorism. 14. Social media. 15. National cohesion. 16. Open offices.

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REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit of competency.

Required Skills

The individual needs to demonstrate the following skills:

- Personal hygiene practices.
- Intra and Interpersonal skills.
- Communication skills.
- Knowledge management.
- Interpersonal skills.
- Critical thinking skills.
- Observation skills.
- Organizing skills.
- Negotiation skills.
- Monitoring skills.

- Evaluation skills.
- Record keeping skills.
- Problem solving skills.
- Decision making skills.
- Resource utilization skills.
- Resource mobilization skills.

Required Knowledge

The individual needs to demonstrate knowledge of:

- Work values and ethics.
- Company policies.
- Company operations, procedures and standards.
- Occupational Health and safety procedures.
- Fundamental rights at work.
- Personal hygiene practices.
- Workplace communication.
- Concept of time.
- Time management.
- Decision making.
- Types of resources.
- Work planning.
- Resources and allocating resources.
- Organizing work.
- Monitoring and evaluation.
- Record keeping.
- Workplace problems and how to deal with them.
- Negotiation.
- Assertiveness.
- Team work.
- Gender mainstreaming.
- HIV and AIDS.
- Drug and substance abuse.
- Leadership.
- Safe work habits
- Professional growth and development.
- Technology in the workplace.
- Learning.
- Creativity.
- Innovation.
- Emerging issues;
    - Social media
    - Terrorism.

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- National cohesion.

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical aspects of Competency	Assessment requires evidence that the learner: 1.1 Attained job targets within key result areas. 1.2 Maintained intra- and inter-personal relationship in the course of managing oneself. 1.3 Completed trainings and career progression opportunities in time. 1.4 Was punctual and time conscious. 1.5 Acquired and maintained licenses and/or certifications required for the job. 1.6 Planned and organized resources to achieve organization goals and objectives. 1.7 Monitored and evaluated work activities. 1.8 Identified, analyzed and solved problem arising in the course of working. 1.9 Was conscious of health and safety while carrying out work functions. 1.10 Maintained a mentorship and coaching program for employees. 1.11 Innovatively made work processes and procedures more efficient. 1.12 Mainstreamed gender issues in the workplace. 1.13 Build a strong team of workers in the workplace. 1.14 Sought and allocated learning opportunities and resources in the workplace. 1.15 Demonstrated awareness of HIV and AIDS. 1.16 Abstained from drug and substance abuse. 1.17 Demonstrated ability to cope with emerging issues.
2. Resource Implications	The following resources should be provided: 2.1 Workplace or assessment location 2.2 Case studies/scenarios
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Oral Interview 3.2 Observation 3.3 Third Party Reports 3.4 Written
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

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	whether individually or in-group
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

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DEMONSTRATE ENVIRONMENTAL LITERACY

UNIT CODE: ENG/OS/CE/BC/5/6

UNIT DESCRIPTION

This unit specifies the competencies required to follow procedures for environmental hazard control, follow procedures for environmental pollution control, comply with workplace sustainable resource use, evaluate current practices in relation to resource usage, develop and adhere to environmental protection principles/strategies/guidelines, analyse resource use, develop resource conservation plans and implement selected plans.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Control environmental hazard.	1.1 ***Storage methods*** for environmentally hazardous materials are strictly followed according to environmental regulations and OSHS. 1.2 ***Disposal methods*** of hazardous wastes are followed at all times according to environmental regulations and OSHS. 1.3 ***PPE*** is used according to OSHS.
2. Control environmental Pollution control.	2.1 Environmental pollution ***control measures*** are compiled following standard protocol. 2.2 Procedures for solid waste management are observed according Environmental Management and Coordination Act 1999. 2.3 Methods for minimizing ***noise pollution*** complied following environmental regulations.
3. Demonstrate sustainable resource use.	3.1 Methods for minimizing wastage are complied with. 3.2 Waste management procedures are employed following principles of 3Rs (Reduce, Reuse, and Recycle). 3.3 Methods for economizing or reducing resource consumption are practiced.
4. Evaluate current practices in relation to resource usage.	4.1 Information on resource efficiency systems and procedures are collected and provided to the work group where appropriate. 4.2 Current resource usage is measured and recorded by members of the work group. 4.3 Current purchasing strategies are analyzed and

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ELEMENT These describe the key outcomes which make up workplace function.	PERFORMANCE CRITERIA These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
	recorded according to industry procedures. 4.4 Current work processes to access information and data is analyzed following enterprise protocol.
5. Identify Environmental legislations/conventions for environmental concerns.	5.1 Environmental legislations/conventions and local ordinances are identified according to the different environmental aspects/impact 5.2 Industrial standard/environmental practices are described according to the different environmental concerns
6. Implement specific environmental programs.	6.1 Programs/Activities are identified according to organizations policies and guidelines. 6.2 Individual roles/responsibilities are determined and performed based on the activities identified. 6.3 Problems/constraints encountered are resolved in accordance with organizations' policies and guidelines 6.4 Stakeholders are consulted based on company guidelines
7. Monitor activities on Environmental protection/Programs.	7.1 Activities are periodically monitored and Evaluated according to the objectives of the environmental program. 7.2 Feedback from stakeholders are gathered and considered in Proposing enhancements to the program based on consultations. 7.3 Data gathered are analyzed based on Evaluation requirements. 7.4 Recommendations are submitted based on the findings 7.5 Management support systems are set/established to sustain and enhance the program. 7.6 Environmental incidents are monitored and reported to Concerned/proper authorities.
8. Analyze resource use.	8.1 All resource consuming processes are Identified 8.2 Quantity and nature of Resource consumed is determined 8.3 Resource flow is analysed through different parts of the process. 8.4 Waste is classified for possible source of resources.

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ELEMENT These describe the key outcomes which make up workplace function.	PERFORMANCE CRITERIA These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
9. Develop resource Conservation plans.	9.1. Efficiency of use/conversion of resources is determined following industry protocol. 9.2. Causes of low efficiency of use of resources are Determined based on industry protocol. 9.3. Plans for increasing the efficiency of resource use are developed based on findings.

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variable	Range
1. PPE May include but are not limited to:	1.1 Mask. 1.2 Gloves. 1.3 Goggles. 1.4 Safety hat. 1.5 Overall. 1.6 Hearing protector.
2. Environmental pollution Control measures include but are not limited to:	2.1 Methods for minimizing or stopping spread and ingestion of airborne particles. 2.2 Methods for minimizing or stopping spread and ingestion of gases and fumes. 2.4 Methods for minimizing or stopping spread and ingestion of liquid wastes.
3. Wastes include but are not limited to:	3.1 Unnecessary waste. 3.2 Necessary waste.
4. Waste management Procedures include but are not limited to:	4.1 Sorting. 4.2 Storing of items. 4.2 Recycling of items. 4.3 Disposal of items.
5. Resources may include but are not limited to:	5.1 Electric. 5.2 Water. 5.3 Fuel. 5.4 Telecommunications. 5.5 Supplies. 5.6 Materials.

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Variable	Range
6. Workplace environmental hazards may include but are not limited to:	6.1 Biological hazards. 6.2 Chemical and dust hazards. 6.3 Physical hazards.
7. Organizational systems and procedures include but are not limited to:	7.1 Supply chain, procurement and purchasing. 7.2 Quality assurance. 7.3 Making recommendations and seeking approvals.
8. Legislations/Conventions include but are not limited to:	8.1 EMCA 1999. 8.2 Montreal Protocol. 8.3 Kyoto Protocol.
9. Environmental aspects/impacts include but are not limited to:	9.1 Air pollution. 9.2 Water pollution. 9.3 Noise pollution. 9.4 Solid waste. 9.5 Flood control. 9.6 Deforestation/Denudation. 9.7 Radiation/Nuclear /Radio Frequency/ Microwaves. 9.8 Situation. 9.9 Soil erosion (e.g. Quarrying, Mining, etc.). 9.10 Coral reef/marine life protection.
10. Industrial standards / Environmental practices include but are not limited to:	10.1 ISO standards. 10.2 Company environmental management systems (EMS)
11. Periodic include but are not limited to:	11.1 Hourly. 11.2 Daily 11.3 Weekly 11.4 Monthly 11.5 Quarterly 11.6 Yearly
12. Programs/Activities may include but are not limited to:	12.1 Waste disposal (on-site and off-site). 12.2 Repair and maintenance of equipment. 12.3 Treatment and disposal operations. 12.4 Clean-up activities. 12.5 Laboratory and analytical test. 12.6 Monitoring and evaluation. 12.7 Environmental advocacy programs.

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EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1.Critical aspects of competency	Assessment requires evidence that the learner: 1.1 Controlled environmental hazard. 1.2 Controlled environmental pollution. 1.3 Demonstrated sustainable resource use. 1.4 Evaluated current practices in relation to resource usage. 1.5 Demonstrated knowledge of environmental legislations and local ordinances according to the different environmental issues /concerns. 1.6 Described industrial standard environmental practices according to the different environmental issues/concerns. 1.7 Resolved problems/ constraints encountered based on management standard procedures. 1.8 Implemented and monitored environmental practices on a periodic basis as per company guidelines. 1.9 Recommended solutions for the improvement of the program 1.10 Monitored and reported to proper authorities any environmental incidents.
2. Resource Implications.	The following resources should be provided: 2.1 Workplace with storage facilities 2.2 Tools, materials and equipment relevant to the tasks (e.g. Cleaning tools, cleaning materials, trash bags) 2.3 PPE, manuals and references 2.4 Legislation, policies, procedures, protocols and local ordinances relating to environmental protection 2.5 Case studies/scenarios relating to environmental Protection
3 Methods of Assessment.	Competency in this unit may be assessed through: 3.1 Demonstration. 3.2 Oral questioning. 3.3 Written examination. 3.4 Interview/Third Party Reports. 3.5 Portfolio (citations/awards from GOs and NGOs, certificate of training – local and abroad).

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	3.6 Simulations and role-play.
4 Context of Assessment	Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment.
5 Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit of competency.

Required Skills

The individual needs to demonstrate the following skills:

- Following storage methods of environmentally hazardous materials.
- Following disposal methods of hazardous wastes.
- Using PPE.
- Practicing OSHS.
- Complying environmental pollution control.
- Observing solid waste management.
- Complying methods of minimizing noise Pollution.
- Complying methods of minimizing wastage.
- Employing waste management procedures.
- Economizing resource consumption.
- Listing of resources used.
- Measuring current usage of resources.
- Identifying and reporting workplace environmental hazards.
- Conveying all environmental issues.
- Following environmental regulations.
- Identifying environmental regulations.
- Assessing procedures for assessing compliance.
- Collecting information on environmental and resource efficiency systems and procedures, and providing information to the work group.
- Measuring and recording current resource usage.
- Analysing and recording current purchasing strategies.
- Analysing current work processes to access information and data and assisting identifying areas for improvement.
- Analysing resource flow.
- Determining efficiency of use/conversion of resources.
- Determining causes of low efficiency of use.
- Developing plans for increasing the efficiency of resource use.

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- Checking resource use plans.
- Complying with regulations/licensing requirements.
- Determining benefit/cost of plans.
- Ranking proposals based on benefit/cost compared to limited resources.
- Checking proposals meet regulatory requirements.
- Monitoring implementation.
- Making adjustments to plan and implementation.
- Checking new resource usage.

Required Knowledge

The individual needs to demonstrate knowledge of:

- Storage methods of environmentally hazardous materials.
- Disposal methods of hazardous wastes.
- Usage of PPE Environmental regulations.
- OSHS.
- Types of pollution.
- Environmental pollution control measures.
- Different solid wastes
- Solid waste management.
- Different noise pollution.
- Methods of minimizing noise pollution.
- Methods of minimizing wastage.
- Waste management procedures.
- Economizing of resource consumption.
- Principle of 3Rs.
- Types of resources.
- Techniques in measuring current usage of resources.
- Calculating current usage of resources.
- Types of workplace environmental hazards.
- Environmental regulations.
- Environmental regulations applying to the enterprise.
- Procedures for assessing compliance with environmental regulations.
- Collection of information on environmental and resource efficiency systems and procedures.
- Measurement and recording of current resource usage
- Analysis and recording of current purchasing strategies.
- Analysis current work processes to access information and data Analysis of data and information.
- Identification of areas for improvement.
- Resource consuming processes.
- Determination of quantity and nature of resource consumed
- Analysis of resource flow of different parts of the resource flow process.

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- Use/conversion of resources.
- Causes of low efficiency of use.
- Increasing the efficiency of resource use.
- Inspection of resource use plans
- Regulations/licensing requirements
- Determine benefit/cost for alternative resource sources.
- Benefit/costs for different alternatives.
- Components of proposals
- Criteria on ranking proposals.
- Regulatory requirements.
- Proposals for improving resource efficiency.
- Implementation of resource efficiency plans.
- Procedures in monitor implementation.
- Adjustments of implementation plan.
- Inspection of new resource usage.

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DEMONSTRATE OCCUPATIONAL SAFETY AND HEALTH PRACTICES

UNIT CODE: ENG/OS/CE/BC/6/6

UNIT DESCRIPTION

This unit specifies the competencies required to lead the implementation of workplace safety and health program, procedures and policies/guidelines.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
5.1 Identify workplace hazards	**1.1** ***Hazards*** in the workplace and/or its ***indicators*** of its presence, are identified. **1.2** ***Evaluation and/or work environment*** measurements of OSH hazards/risk existing in the workplace is conducted by authorized personnel or agency. **1.3** ***OSH issues and/or concerns*** raised by workers are gathered.
1. Identify and implement appropriate control measures	2.1 Prevention ***and control measures***, including use of s***afety gears / PPE (personal protective equipment)*** for specific hazards identified and implemented. 2.2 Appropriate ***risk controls*** based on result of OSH hazard evaluation is recommended. 2.3 ***Contingency measures***, including ***emergency procedures*** during workplace ***incidents and emergencies*** are recognized and established in accordance with organization procedures.
2. Implement OSH programs, procedures and policies/ guidelines	3.1 Information to work team about company OSH program, procedures and policies/guidelines are provided. 3.2 Implementation of OSH procedures and policies/ guidelines are participated. 3.3 Team members are trained and advised on OSH standards and procedures. 3.4 Procedures for maintaining ***OSH-related records*** are implemented.

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RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variable	Range
1. ***Hazards may include*** but are not limited to:	1.1. Physical hazards – impact, illumination, pressure, noise, vibration, extreme temperature, radiation. 1.2 Biological hazards- bacteria, viruses, plants, parasites, mites, molds, fungi, and insects. 1.3 Chemical hazards – dusts, fibres, mists, fumes, smoke, gasses and vapours. 1.4 Ergonomics; Psychological factors – over exertion/ excessive force, awkward/static positions, fatigue, direct pressure, varying metabolic cycles; Physiological factors – monotony, personal relationship, work out cycle; 1.6 Safety hazards (unsafe workplace condition) – confined space, excavations, falling objects, gas leaks, electrical, poor storage of materials and waste, spillage, waste and debris; 1.7 Unsafe workers' act (Smoking in off-limited areas, Substance and alcohol abuse at work);
2. ***Indicators may include*** but are 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. ***Evaluation and/or work environment measurements*** may include but are not limited to:	3.1 Health Audit; 3.2 Safety Audit; 3.3 Work Safety and Health Evaluation; 3.4 Work Environment Measurements of Physical and Chemical Hazards.
4. ***OSH issues and/or concerns*** may include but are not limited to:	4.1 Workers' experience/observance on presence of work hazards. 4.2 Unsafe/unhealthy administrative arrangements (prolonged work hours, no break time, constant overtime, scheduling of tasks). 4.3 Reasons for compliance/non-compliance to use of PPEs or other OSH procedures/policies/guidelines.

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Variable	Range
5. ***Prevention and control measures*** may include but are not limited to:	5.1 Eliminate the hazard (i.e., get rid of the dangerous machine 5.2 Isolate the hazard (i.e. keep the machine in a closed room and operate it remotely; barricade an unsafe area off) 5.3 Substitute the hazard with a safer alternative (i.e., replace the machine with a safer one). 5.4 Use administrative controls to reduce the risk (i.e. give trainings on how to use equipment safely; OSH-related topics, issue warning signage, rotation/shifting work schedule). 5.5 Use engineering controls to reduce the risk (i.e. use safety guards to machine). 5.6 Use personal protective equipment. 5.7 Safety, Health and Work Environment Evaluation. 5.8 Periodic and/or special medical examinations of workers.
6. ***Safety gears /PPE (Personal Protective Equipment)*** may include but are not limited to:	6.1 Arm/Hand guard, gloves. 6.2 Eye protection (goggles, shield). 6.3 Hearing protection (ear muffs, ear plugs). 6.4 Hair Net/cap/bonnet. 6.5 Hard hat. 6.6 Face protection (mask, shield). 6.7 Apron/Gown/coverall/jump suit. 6.8 Anti-static suits. 6.9 High-visibility reflective vest.
7. Appropriate risk controls	Appropriate risk controls in order of impact are as follows: 7.1 Eliminate the hazard altogether (i.e., get rid of the dangerous machine). 7.2 Isolate the hazard from anyone who could be harmed (i.e., keep the machine in a closed room and operate it remotely; barricade an unsafe area off). 7.3 Substitute the hazard with a safer alternative (i.e. replace the machine with a safer one). 7.4 Use administrative controls to reduce the risk (i.e. train workers how to use equipment safely; train workers about the risks of harassment; issue signage). 7.5 Use engineering controls to reduce the risk (i.e., attach guards to the machine to protect users). 7.6 Use personal protective equipment (i.e. wear gloves and goggles when using the machine)
8. ***Contingency measures*** may include but are not limited to:	8.1 Evacuation. 8.2 Isolation. 8.3 Decontamination. 8.4 (Calling designed) emergency personnel.

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Variable	Range
9. ***Emergency procedures*** may include but are not limited to:	9.1 Fire drill. 9.2 Earthquake drill. 9.3 Basic life support/CPR. 9.4 First aid. 9.5 Spillage control. 9.6 Decontamination of chemical and toxic 9.7 Disaster preparedness/management 9.8 se of fire-extinguisher.
10. ***Incidents and emergencies*** may include but are not limited to:	10.1 Chemical spills. 10.2 Equipment/vehicle accidents. 10.3 Explosion 10.4 Fire 10.5 Gas leak. 10.6 Injury to personnel. 10.7 Structural collapse. 10.8 Toxic and/or flammable vapours emission.
11. ***OSH-related Records*** may include but are not limited to:	11.1 Medical/Health records. 11.2 Incident/accident reports. 11.3 Sickness notifications/sick leave application. 11.4 OSH-related trainings obtained

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REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit of competency.

Required Skills

The individual needs to demonstrate the following skills:

- Skills on preliminary identification of workplace hazards/risks
- Knowledge management.
- Critical thinking skills.
- Observation skills.
- Coordinating skills.
- Communication skills.
- Interpersonal skills.
- Troubleshooting skills.
- Presentation skills.
- Training skills

Required Knowledge

The individual needs to demonstrate knowledge of:

- General OSH Principles.
- Occupational hazards/risks recognition.
- OSH organizations providing services on OSH evaluation and/or work environment measurements (WEM).

- National OSH regulations; company OSH policies and protocols.
- Systematic gathering of OSH issues and concerns.
- General OSH principles.
- National OSH regulations.
- Company OSH and recording protocols, procedures and policies/guidelines.
- Training and/or counselling methodologies and strategies.

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical Aspects of Competency	Assessment requires evidence that the learner: 1.1 Identifies hazards/risks in the workplace and/or its indicators. 1.2 Requests for evaluation and/or work environment measurements of OSH hazards/risk in the workplace. 1.3 Gathers OSH issues and/or concerns raised by workers. 1.4 Identifies and implements prevention and control measures, including use of PPE (personal protective equipment) for specific hazards. 1.5 Recommends appropriate risk controls based on result of OSH hazard evaluation and OSH issues gathered. 1.6 Establish contingency measures, including emergency procedures in accordance with organization procedures. 1.7 Provides information to work team about company OSH program, procedures and policies/guidelines. 1.8 Participates in the implementation of OSH procedures and policies/guidelines. 1.9 Trains and advises team members on OSH standards and procedures. 1.10 Implements procedures for maintaining OSH-related records.
2. Resource Implications.	The following resources should be provided: 2.1 Workplace or assessment location. 2.2 OSH personal records. 2.3 PPE. 2.4 Health records.
3. Methods of Assessment.	Competency may be assessed through: 3.1 Portfolio Assessment. 3.2 Interview. 3.3 Case Study/Situation. 3.4 Observation/Demonstration and oral questioning.
4. Context of Assessment.	Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment.

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5. Guidance information for assessment.	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

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COMMON UNITS OF COMPETENCY

APPLY MATHEMATICAL SKILLS

UNIT CODE:ENG/OS/CE/CC/01/6

UNIT DESCRIPTION

This unit describes the competencies required by a technician in order to apply algebra apply trigonometry and hyperbolic functions, apply complex numbers, apply coordinate geometry, carry out binomial expansion, apply calculus, solve ordinary differential equations, carry out mensuration, apply power series, apply statistics, apply numerical methods, apply vector theory and apply matrix.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. *Bold and italicized terms are elaborated in the Range.*
1. Apply Algebra	1.1 Calculations involving Indices are performed as per the concept 1.2 Calculations involving Logarithms are performed as per the concept 1.3 Scientific calculator is used in solving mathematical problems in line with manufacturer's manual 1.4 Simultaneous equations are performed as per the rules 1.5 Quadratic equations are calculated as per the concept
2. Apply Trigonometry and hyperbolic functions	2.1 Calculations are performed using trigonometric rules 2.2 Calculations are performed using ***hyperbolic functions***
3. Apply complex numbers	3.1complex numbers are represented using Argand diagrams 3.2 Operations involving complex numbers are performed 3.3 Calculations involving complex numbers are performed using De Moivre's theorem
4. Apply Coordinate Geometry	4.1Polar equations are calculated using coordinate geometry

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ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. *Bold and italicized terms are elaborated in the Range.*
	4.2 Graphs of given polar equations are drawn using the Cartesian plane 4.3 Normal and tangents are determined using coordinate geometry
5. Carry out Binomial Expansion	5.1 Roots of numbers are determined using binomial theorem 5.2 Errors of small changes are determined using binomial theorem
6. Apply Calculus	6.1 Derivatives of functions are determined using Differentiation 6.2 Derivatives of hyperbolic functions are determined using Differentiation 6.3 Derivatives of inverse trigonometric functions are determined using Differentiation 6.4 Rate of change and small change are determined using Differentiation. 6.5 Calculation involving stationery points of functions of two variables are performed using differentiation. 6.6 Integrals of algebraic functions are determined using integration 6.7 Integrals of trigonometric functions are determined using integration 6.8 Integrals of logarithmic functions are determined using integrationIntegrals of hyperbolic and inverse functions are determined using integration
7. Solve Ordinary differential equations	7.1 First order and second order differential equations are solved using the method of undetermined coefficients 7.2 First order and second order differential equations are solved from given boundary conditions
8. Carry out Mensuration	8.1 Perimeter and areas of figures are obtained 8.2 Volume and of Surface area of solids are obtained 8.3 Area of irregular figures are obtained 3.4 Areas and volumes are obtained using Pappus theorem
9. Apply Power Series	9.0 Power series are obtained using Taylor's Theorem 9.1 Power series are obtained using Maclaurin's 's theorem
10. Apply Statistics	10.1 Mean, median ,mode and Standard deviation are obtained from given data 10.2 Calculations are performed based on Laws of

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ELEMENT These describe the key outcomes which make up workplace function.	PERFORMANCE CRITERIA These are assessable statements which specify the required level of performance for each of the elements. *Bold and italicized terms are elaborated in the Range.*
	probability 10.3 Calculation involving ***probability distributions*** , mathematical expectation sampling distributions are performed 10.4 Sampling distribution methods are applied in data analysis 10.5 Calculations involving use of standard normal table, sampling distribution, T-distribution and Estimation are done 10.6 Confidence intervals are determined
11. Apply Numerical methods	11.1 Roots of polynomials are obtained using iterative ***numerical methods*** 11.2 interpolation and extrapolation are performed using numerical methods
12. Apply Vector theory	12.1 Vectors and scalar quantities are obtained in two and three dimensions 12.2 ***Operations*** on vectors are performed 12.3 Position of vectors is obtained 12.4 Resolution of vectors is done
13. Apply Matrix	13.1 Determinant and inverse of 3x3 matrix are obtained 13.2 Solutions of simultaneous equations are obtained 13.3 Calculation involving Eigen values and Eigen vectors are performed

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RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variable	Range
1. Operations include but not limited to:	1.1. Addition 1.2. subtraction
2. Hyperbolic functions include but not limited to:	2.1. Sinh x 2.2. Cosh x 2.3. Cosec x 2.4. Coth x

	2.5. Tanh x 2.6. Sech x
3. Probability Distributions include but not limited to:	3.1. Binomial 3.2. Poisson 3.3. Normal
4. Numerical Methods include but not limited to:	4.1. Newton Raphson 4.2. Gregory Newton

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit of competency.

Required Skills

The individual needs to demonstrate the following skills:

- Applying fundamental operations (addition, subtraction, division, multiplication)
- Using and applying mathematical formulas
- Logical thinking
- Problem solving
- Applying statistics
- Drawing graphs
- Using different measuring tools

Required knowledge

The individual needs to demonstrate knowledge of:

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- Fundamental operations (addition, subtraction, division, multiplication)
- Calculating area and volume
- Types and purpose of measuring instruments
- Units of measurement and abbreviations
- Rounding techniques
- Types of fractions
- Types of tables and graphs
- Presentation of data in tables and graphs
- Vector operations
- Matrix operations

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

13. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.4 Applied Trigonometry and hyperbolic functions 1.5 Applied complex numbers 1.6 Applied Calculus

	1.7 Solved Ordinary differential equations 1.8 Carried out mensuration 1.9 Applied Power Series 1.10 Applied Vector theory 1.11 Applied Matrix 1.12 Applied Numerical methods
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 Measuring equipment 2.3 Materials relevant to the proposed activity or tasks
14. Methods of Assessment	Competency in this unit may be assessed through: 1.1 Direct Observation 1.2 Demonstration with Oral Questioning 1.3 Written tests
Context of Assessment	Competency may be assessed individually in the actual workplace or through accredited institution
Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

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PREPARE AND INTERPRET TECHNICAL DRAWINGS

UNIT CODE: ENG/OS/CE/CC/2/6

UNIT DESCRIPTION

This unit covers the competencies required to prepare and interpret technical drawings. It involves competencies to select, use and maintain drawing equipment and materials. It also involves producing plain geometry drawings, solid geometry drawings, pictorial and orthographic drawings and application of Computer Aided Design (CAD) packages.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. *Bold and italicized terms are elaborated in the Range.*
1. Use and maintain drawing equipment and materials	1.1 ***Drawing equipment*** are identified and gathered according to task requirements 1.2 ***Drawing materials*** are identified and gathered according to task requirements 1.3 Drawing equipment are used and maintained as per manufacturer's instructions 1.4 Drawing materials are used as per workplace procedures 1.5 Waste materials are disposed in accordance with workplace procedures and ***environmental legislations*** 1.6 ***Personal Protective Equipment*** is used according to occupational safety and health regulations
2. Produce plane geometry drawings	2.1 Different types of lines used in drawing and their meanings are identified according to standard drawing conventions 2.2 Different types of ***geometric forms*** are constructed according to standard conventions 2.3 Different types of angles are constructed according to principles of trigonometry 2.4 Different types of angles are measured using appropriate measuring tools 2.5 Angles are bisected according to standard conventions 2.6 Freehand sketching of different types of geometric forms, tools, equipment, diagrams is conducted
3. Produce solid geometry	3.1 Drawings of patterns are interpreted according to

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ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. *Bold and italicized terms are elaborated in the Range.*
drawings	standard conventions 3.2 Patterns are developed in accordance with standard conventions
4. Produce orthographic and pictorial drawings	4.1 Symbols and abbreviations are identified and their meaning interpreted according to standard drawing conventions 4.2 First and third angle orthographic drawings are interpreted and produced in accordance with the standard conventions 4.3 Orthographic elevations are dimensioned in accordance with standard conventions 4.4 Isometric drawings are interpreted and produced in accordance with standard conventions
5. Produce electrical drawings	5.1 Electrical symbols and abbreviations are identified and their meaning interpreted according to BS 3939 5.2 ***Electrical drawings*** are produced in accordance with BS 3939
6. Apply CAD packages	6.1 CAD packages are selected according to task requirements 6.2 CAD packages are applied in production of electrical drawings

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RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variable	**Range**
1. Drawing equipment include but is not limited to:	Drawing boards, T and set squares, drawing sets, computers with CAD packages.
2. Drawing materials include but is not limited to:	Drawing papers, pencils, erasers, masking tapes, paper clips
3. Environmental legislations include but is	EMCA 1999

not limited to:	
4. Personal Protective Equipment include but is not limited to:	Dust coats, closed leather shoes
5. Geometric forms include but is not limited to:	Circles, triangles, rectangles, parallelogram, polygons, pyramids, conic sections, prisms, loci
6. Standard conventions include but is not limited to:	• Anatomy of engineering drawing (title block, coordinate grid system, revision block, notes and legends) • Drawing scale (paper size and drawing symbols) • International drawing standards
7. Electrical drawings include but is not limited to:	Block, schematic, circuit, line and wiring diagrams

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit of competency.

Required skills

The individual needs to demonstrate the following skills:

- Critical thinking
- Drawing
- Interpretation
- Drawing equipment handling
- Analysis and synthesis
- Communication
- Inter personal

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Required knowledge

The individual needs to demonstrate knowledge of:

- Drawing equipment and materials
- Freehand sketching
- Lettering
- Geometrical constructions
- Types of drawings
- Types of lines
- Isometric drawing conventions, features, characteristics, components
- Orthographic drawing conventions, features, characteristics, components
- Sketches and drawings of simple patterns

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required knowledge and understanding and range.

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Applied and adhered to safety procedures 1.2 Cared and maintained drawing equipment 1.3 Interpreted circuit, assembly and lay out diagrams 1.4 Applied appropriate technical standards, used proper tools and equipment for a given task 1.5 Produced sketches and drawings 1.6 Applied CAD packages in production of drawings
2. Resource Implications	Resources the same as that of workplace are advised to be applied. 2.1 Drawing room 2.2 Drawing equipment and materials 2.3 Computers 2.4 CAD packages
3. Methods of Assessment	Competency may be assessed through: 3.1 Practical tests 3.2 Observation
4. Context of Assessment	Competency may be assessed individually in the actual workplace or a simulated work place setting
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

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APPLY CHEMICAL SCIENCE

UNIT CODE: ENG/OS/CE/CC/3/6

UNIT DESCRIPTION

This unit covers the competencies required to apply inorganic chemistry, organic chemistry, physical chemistry, biochemistry and microbiology.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT	**PERFORMANCE CRITERIA** *(Bold and italicised terms are elaborated in the Range)*
1. Apply inorganic chemistry	1.1 Ionic and covalent bonds are identified and their properties determined 1.2 The ***periodic table*** is understood 1.3 Prepare solutions of known concentration 1.4 solutions are standardized 1.5 a material is electroplated 1.6 a crystal is prepared
2. Apply organic chemistry	2.1 ***Organic compounds*** are identified 2.2 P***roperties of organic compounds*** are determined 2.3 organic compounds are prepared
5. Apply physical chemistry	3.1 Gases are liquified 3.2 Solutions are prepared 3.3 Crystals are made 3.4 Fractional distillation is performed 3.5 Titration is performed 3.6 Chemical reactions are analyzed
6. Apply biochemistry	4.1 Light microscope is used to identify organelles 4.2 ***Substrates*** are identified, classified and tested 4.3 Enzymes are identified and tested
7. Apply microbiology	5.1 Microbes are classified 5.2 Microbes are grown 5.3 Microbes are observed and stained and counted 5.4 Fermentation process is performed using microbes 5.5 Microbes are sterilized 5.6 Microbes are safely disposed

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RANGE

Variable	**Range**
Periodic table include but is not limited to:	• s- block elements • p- block elements • d- block elements

Organic compounds	• Hydrocarbons • Alkylhalides • Aromatic compounds • Hydroxyl compounds/ alcohol • Carbonyl compounds • Carboxylic acids • Esters • Organo-nitrogen compounds • Polymers
Properties of organic compounds	• Physical properties • Chemical properties
Substrates	• Protein • Carbohydrates • Lipids • Nucleic acids • Vitamins

REQUIRED SKILLS AND KNOWLEDGE

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This section describes the skills and knowledge required for this unit of competency.

Required skills

The individual needs to demonstrate the following skills:

- Preparing solutions
- Electroplating
- Standardize solutions
- Crystallizing
- Titration
- Distilling
- Report writing
- Organizing and planning
- Collecting data

Required knowledge

The individual needs to demonstrate knowledge of:

- Periodic table
- Types of bonds
- Crystallization
- Solutions
- Concentrations
- Organic compounds

- Microbes
- Microscopes
- Gases
- States of matter

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required knowledge and understanding and range.

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 understood the ***periodic table*** 1.2 Prepared solutions of known concentration 1.3 standardized solutions 1.4 prepared crystals 1.5 used a light microscope 1.1 tested substrates 1.2 tested enzymes 1.3 observed and stained and counted microbes 1.4 Performed fermentation process using microbes 1.5 Sterilized microbes 1.6 Safely disposed microbes
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 Laboratory 2.3 Relevant reagents 2.4 Relevant apparatus
3. Methods of Assessment	Competency may be assessed through: 3.1 Practical tests 3.3 Observation
4. Context of Assessment	Competency may be assessed individually in the actual workplace or a simulated work place setting
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

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APPLY ELECTRICAL SCIENCE

UNIT CODE:ENG/OS/CE/CC/4/6

UNIT DESCRIPTION

This unit describes the competencies required by a technician in order to apply a wide range of Electrical principles skills in their work; use the concept of basic Electrical quantities, use the concepts of D.C and A.C circuits in electrical installation, use of basic electrical machine, use of power factor in electrical installation, use of earthing in Electrical installations, use of earthing in Electrical installations and apply lightning protection measures

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range.***
1. Use the concept of basic Electrical quantities	1.1 Basic ***SI unit***s in Electrical are identified 1.2 ***Quantitie***s of Charge, force, work and power are identified 1.3 Calculations involving various electrical quantities are performed
2. Use the concepts of D.C and A.C circuits in electrical installation	2.1 Perform calculations involving Ohm's law that is Current, Resistance and voltage 2.2 Calculations involving parallel and series circuits are performed 2.3 Calculations involving DC and AC Network theorems are performed. E.g. Kirchhoff's laws, Superposition, Thevinin's, Norton's
3. Use of basic electrical machine	3.1 Types of various electrical machines are identified 3.2 Calculations involving single phase and three phase AC and DC Motors are performed 3.3 Calculations involving single and three phase AC and DC transformers are performed 3.4 Calculations involving single and three phase generators are performed
4. Use of power factor in electrical installation	3.1 Power triangle is identified i.e. Active, Apparent and reactive power 3.2 The use of power factor is performed 3.3 Calculations involving power factor correction is performed 3.4 Methods of power factor correction are applied
5. Use of earthing in Electrical installations	5.1 Earthing types are identified 5.2 Earthing points on Electrical installation are identified

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ELEMENT These describe the key outcomes which make up workplace function.	PERFORMANCE CRITERIA These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range.***
	5.3 Calculation involved in determining the earthing type is performed 5.4 Test on an earthling system is performed in line with the IEE regulations
6. Apply lightning protection measures	6.1 Types of lightening strokes are identified 6.2 Components of lightening protection system are identified 6.3 Test to be carried out in lightening protection system are established 6.4 Application of lightening protection system is determined

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

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Variable	Range
1. SI unit include but not limited to:	1.1 Power – Watts (W) 1.2 Current – Amperes (A) 1.3 Resistance – Ohms(Ω) 1.4 Voltage – Volts (V)
2. Quantities include but not limited to:	2.1 Charge 2.2 Force 2.3 Work 2.4 Power

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit of competency.

Required Skills

The individual needs to demonstrate the following skills:

- Apply basic Electrical formulas
- Use of basic Electrical instruments
- Perform various unit conversions of Electrical quantities
- Electrical earthing
- Lightening arrestors
- Power factor correction

- logical thinking
- problem solving
- applying statistics
- drawing graphs
- Using different measuring tools

Required knowledge

The individual needs to demonstrate knowledge of:

- Electrical power calculations
- Various laws in Electrical engineering
- Electrical formulas
- Power triangle
- SI units of various electrical parameters
- Earthing testing
- Lightening arrestor testing
- Selecting the correct type of electrical machines for various uses
- Types and purpose of measuring instruments
- Units of measurement and abbreviations

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

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1 Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Applied the correct SI units of Electrical quantities 1.2 Stated, Calculate and relates the quantities in Ohm's law 1.3 Identified the components of an earthing system 1.4 Stated and apply various laws in Electrical system 1.5 Differentiated between AC and DC network 1.6 Applied correct formulas in the calculation of AC and DC machines 1.7 Used power triangle in calculating power factor 1.8 Applied various methods in power factor correction 1.9 Identified types of lightening arrestors and their applications
2. Resource Implications	The following resources should be provided: 2.2 Access to relevant workplace or appropriately simulated environment where assessment can take place 2.3 Measuring equipment 2.4 Materials relevant to the proposed activity or tasks
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Direct Observation 3.2 Demonstration with Oral Questioning 3.3 Written tests
Context of Assessment	Competency may be assessed individually in the actual workplace or

	through accredited institution
Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

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APPLY MECHANICAL SCIENCE

UNIT CODE:ENG/OS/CE/CC/5/6

UNIT DESCRIPTION

This unit describes the competencies required by a technician in order to apply a wide range of Mechanical science principles in their work. It includes applying principles of physics, mechanics of machines, solid mechanics and fluid mechanics.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range.***
1. Apply principles of physics	1.1 ***Types of forces*** are identified 1.2 Equilibrium of forces and plane framework are calculated 1.3 Resultant and resolution of forces is performed 1.4 Application of forces is identified 1.5 ***Motions*** are determined 1.6 Equations of motions are applied 1.7 Temperature scales are determined 1.8 Modes of heat transfer are determined 1.9 Coefficient of thermal conductivity is determined 1.10 Coefficient of friction is determined 1.11 Friction equations are derived 1.12 Focal length is determined 1.13 Refractive indices are determined 1.14 Velocity of sound is determined 1.15 Sound level is determined 1.16 Sound is regulated 1.17 Angular momentum is determined 1.18 Momentum of a moving body is determined
2. Apply mechanics of machines	2.1 Velocity ratio, mechanical advantage and efficiency of machines are determined 2.2 ***Principles*** of ***mechanical systems*** are applied 2.3 Principle of conservation of energy is applied
3. Apply solid mechanics	3.1 Tensile and compressive strengths of materials are determined 3.2 Stress and strain graph is plotted 3.3 Strain in pressurized vessels are determined

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ELEMENT These describe the key outcomes which make up workplace function.	PERFORMANCE CRITERIA These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range.***
	3.4 Position and magnitude of greatest bending moments is determined 3.5 Shear force and bending moment diagrams are plotted 3.6 Young's modulus for beams are determined 3.7 Moments for loaded beams are determined 3.8 Slopes and deflections of beams are determined
4. Determine parameters of a fluid system	4.1 ***Laws of fluids*** are identified 4.2 Tools and equipment for measuring system parameters are identified 4.3 Tools and equipment are operated 4.4 Fluid system ***parameters*** are measured 4.5 Measured parameters are recorded and interpreted.

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RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variable	Range
1. Types of forces include but not limited to	1.1 Friction 1.2 Centrifugal 1.3 Centripetal 1.4 Gravitational
2. Motions include but not limited to	2.1 Linear motion 2.2 Circular motions 2.3 Projectile motions 2.4 Simple harmonic motions
3. Mechanical systems include but not limited to	3.1 Pulleys 3.2 Belts 3.3 Gears 3.4 Ropes 3.5 Levers 3.6 Wedge

	3.7 Screws 3.8 Wheel and axle
4. Principles include but not limited to	4.1 Newton's laws of motion 4.2 Law of conservation of linear momentum 4.3 Law of conservation of energy 4.4 Archimedes' principle
5. Laws of fluids include but not limited to	5.1 Pascal's principle 5.2 Gas laws
6. Parameters include but not limited to	6.1 Density 6.2 Velocity 6.3 Temperature 6.4 Viscosity 6.5 Pressure

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit of competency.

Required Skills

The individual needs to demonstrate the following skills:

- Apply basic mechanical formulas
- Use of basic mechanical machines
- Perform various unit conversions of mechanical quantities
- Basic mechanical systems design
- Mechanical machine operation
- Logical thinking
- Problem solving
- Applying statistics
- Drawing graphs
- Using different measuring tools

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Required knowledge

The individual needs to demonstrate knowledge of:

- Newton's law
- Levers
- Gears
- Pulleys
- Laws of conservation of energy
- Laws of friction
- Type of forces
- Thermodynamics
- Calculation of fluid pressure and flow rate
- Mechanical advantage and efficiency calculations
- Properties of materials
- Gas laws

- Strength of materials
- SI units.
- Parameters of fluid system
- Operation of mechanical machines
- Mechanical calculation of power, energy, work done, torque and safety factor

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1 Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Applied principles of physics 1.2 Applied mechanics of machines 1.3 Applied solid mechanics 1.4 Identified laws of fluids
6. Resource Implications	The following resources should be provided: 2.5 Access to relevant workplace or appropriately simulated environment where assessment can take place 2.6 Measuring tools and equipment 2.7 Sample materials to be tested
7. Methods of Assessment	Competency in this unit may be assessed through: 7.1 Direct Observation 7.2 Demonstration with Oral Questioning 7.3 Case studies 7.4 Written tests
Context of Assessment	Competency may be assessed individually in the actual workplace or through accredited institution
Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

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APPLY WORKSHOP TECHNOLOGY

UNIT CODE:ENG/OS/CE/CC/6/6

UNIT DESCRIPTION

This unit describes the competencies required by a technician in order to apply a wide range of workshop technology practices in their work. It includes Observing safety precautions, taking material measurements, performing basic metal works, performing heat treatment, analysing common workshop materials and testing workshop materials.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range.***
1. Observe safety precautions	1.1 ***PPEs*** are gathered and used 1.2 safety rules are adhered to according to workplace procedures 1.3 tools are handled correctly according to manufacturer's manual 1.4 firefighting equipment is used where appropriate
2. Take material measurements	2.1 measuring instruments are identified 2.2 measuring instruments are used according to manufacturer's manual 2.3 measuring instruments are maintained according to manufacturer's guide
3. Perform basic metal works	3.1 materials, tools and equipment are selected 3.2 metals are marked out 3.3 metals are cut using appropriate ***cutting tools*** 3.4 patterns are developed in the sheet metal work 3.5 joints are prepared in the metal work 3.6 ***metal joining*** is performed as per the workshop manual 3.7 drilling operations are performed as per the workshop manual 3.8 grinding operations are performed as per the workshop manual
4. Perform heat treatment	4.1 PPEs are gathered and used as per the workplace procedure 4.2 heat treatment equipment is operated and maintained 4.3 heat treatment is performed 4.4 tests on heated workpieces are performed

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ELEMENT These describe the key outcomes which make up workplace function.	PERFORMANCE CRITERIA These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range.***
5. Analyse common workshop materials	5.1 ***common workshop materials*** are identified and classified 5.2 metal types are analysed as per SOPs
5. Test workshop materials	5.1 test piece is prepared 5.2 tensile testing machine is operated 5.3 materials' tensile and compressive strength is tested 5.4 material hardness is tested

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variable	Range
1. PPE include but not limited to:	1.1 Goggles 1.2 Gloves 1.3 Boots 1.4 Overall 1.5 Helmet 1.6 Hand shield 1.7 Respirators 1.8 Ear muffs
2. Cutting tools include but not limited to:	2.1 Lathe machine 2.2 Hacksaws 2.3 Guillotine machine
3. Metal joining include but not limited to:	3.1 Soft soldering 3.2 Hard soldering 3.3 Riveting 3.4 Gas welding 3.5 Arc welding
4. Common workshop materials include but not limited to:	4.1 Cast iron 4.2 Carbon steels 4.3 Alloy steels 4.4 Non-ferrous metals 4.5 Plastics

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REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit of competency.

Required Skills

The individual needs to demonstrate the following skills:

- Measuring
- Heating metals and plastics
- Cutting metals
- Joining metals
- Drilling metals
- Grinding
- Testing materials
- Planning and organizing
- Housekeeping
- Time management

Required knowledge

- Safety precautions
- Workshop tools' operations and handling
- Properties of materials
- Structures of materials
- Prevention of corrosion
- Types of metals
- Types of metal works
- Plastics

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EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 adhered to safety rules as per workplace procedures 1.2 used measuring instruments according to manufacturer's manual 1.3 metals are marked out 1.4 cut metals using appropriate cutting tools 1.5 developed patterns in the sheet metal work 1.6 Prepared joints in the metal work 1.7 Performed metal joining as per the workshop manual 1.8 Performed drilling operations as per the workshop manual 1.9 Performed grinding operations as per the workshop manual 1.10 Identified, classified and analysed ***common workshop materials***

	1.11 Tested workshop materials
2. Resource Implications	The following resources should be provided: 2.1 PPEs 2.2 Access to relevant workplace or appropriately simulated environment where assessment can take place 2.3 Measuring tools and equipment 2.4 Relevant tools and equipment for metal works 2.5 Sample materials to be tested
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Direct Observation 3.2 Demonstration with Oral Questioning 3.3 Case studies 3.4 Written tests
4. Context of Assessment	Competency may be assessed individually in the actual workplace or through accredited institution
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

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CORE UNITS OF COMPETENCY

MAINTAIN ENVIRONMENTAL HEALTH AND SAFETY (EHS) STANDARDS

UNIT CODE: ENG/OS/CE/CR/1/6

Unit description

This unit covers the knowledge, understanding and skills required for a Chemical Engineering. Technician to maintain health and safety in a workplace where chemical production activities are performed. It includes maintaining shop floor housekeeping, carrying out job risk assessment, monitoring waste and hazardous pollutants, training process members on EHS standards and safety plans, and diagnosing equipment functionality to ensure their and safety in the workplace.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Maintain shop floor housekeeping	1.1 Appropriate ***personal protective equipment (PPE)*** is worn according to the ***cleaning method*** used 1.2 ***Necessary cleaning materials*** & ***equipment*** are identified according to ***SOP*** 1.3 Work areas including ***various surfaces*** are inspected according to ***standard operating procedures (SOP)***. 1.4 Cleaning activity is carried out according to ***SOP***. 1.5 Workplace procedures are followed to deal with any accidental damage caused during the cleaning process according to ***safety standards*** 1.6 ***Process equipment and materials*** are identified and stored in demarcated areas according to ***SOP***
2. Carry out job risk assessment.	2.1 Risk assessment is defined why, when and where it would be carried out according to safety standards. 2.2 ***Methods of identifying risk*** are selected according to safety standards. 2.3 The level of risk is assessed to eliminate or minimise according to safety standard 2.4 Risk assessment information is recorded according to safety standards 2.5 Risk assessment report is prepared according to safety standards
3. Manage process waste	3.1 Different ***types of waste and hazards*** are identified according to safety standards

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ELEMENT These describe the key outcomes which make up workplace function.	PERFORMANCE CRITERIA These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
	3.2 Waste is disposed/treated according to safety standards. 3.3 Environmental hazards and safety incidents are responded to and monitored according to safety standards 3.4 Environmental hazards/incidents and wastes are recorded and reported according to safety standards
4. Train teamwork for emergency evacuation	4.1 New team members are trained on emergency evacuation procedures according to safety standards 4.2 Process members are trained on how to use ***safety equipment*** according to safety standards 4.3 Process members are trained on how to use emergency exits according to safety standards. 4.4 Process members are trained on ***safety plans*** according to safety standards 4.5 Process members to carry out a mock emergency evacuation drill according to safety standards.
5. Train teamwork for EHS standard	5.1 New team members are trained on health and safety according to safety standards 5.2 Process members are trained on how to use ***safety equipment*** according to safety standards 5.3 Process members are trained on how to use PPE according to safety standards. 5.4 Process members are trained on ***safety plans*** according to safety standards
6. Monitor safety incidents and near misses	6.1 Acquire occurrence book according safety standards 6.2 Inspect operation according to SOP 6.3 Identify near misses and incidences according to safety standards 6.4 Record near misses and incidences in the occurrence book according to safety standards.
7. Check safety equipment functionality	7.1 Safety equipment is inspected according to the safety standards. 7.2 Safety equipment is tested according to the manufacturer's manuals 7.3 The reports of inspection and testing are recorded according to safety standards

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ELEMENT These describe the key outcomes which make up workplace function.	PERFORMANCE CRITERIA These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
8. Monitor environmental pollutions	8.1 Acquire occurrence book according to environmental management systems (EMS) 8.2 Inspect processes according to EMS. 8.3 Inspect process outlets according to EMS. 8.4 Identify sources of pollutants according to EMS 8.5 Record findings in the occurrence book according to EMS

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance

Variable	Range
1. Others include but not limited to*:*	1.1 Equipment 1.2 Products 1.3 Other employees 1.4 Company visitors
2. Various surfaces include but not limited to*:*	2.1 Floor 2.2 Walls 2.3 Ceilings 2.4 Equipment surfaces
3. Standard Operating Procedures (SOP) include but not limited to*:*	3.1. Inspection methods 3.2. Cleaning activities 3.3. Operation manuals 3.4. Testing procedures 3.5. Data record formats 3.6. Company Instructions
4. Cleaning materials include but not limited to*:*	4.1 Detergents 4.2 Acids 4.3 Solvents 4.4 Water 4.5 Alkali
5. Cleaning equipment include but not limited to*:*	5.1 Hard-water cleaner 5.2 Squeezer 5.3 Vacuum cleaner 5.4 Bucket 5.5 Brushes 5.6 Cleaning in place units
6. Personal protective	6.1 Helmet

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Variable	Range
equipment (PPE) include but not limited to:	6.2 Gloves 6.3 Face mask and Goggles 6.4 Protective clothing 6.5 Foot protection 6.6 Hearing protection 6.7 Respiratory protection
7. Cleaning methods include but not limited to:	7.1. Wet 7.2. Dry
8. Methods of identifying hazards include but not limited to:	8.1 Health & Safety audits 8.2 Consultation with other workers 8.3 Near miss & Accident reports 8.4 Research papers 8.5 Manufacturers of equipment and materials 8.6 Monitoring records
9. Types of waste include but not limited to:	9.1 Solid 9.2 Liquid 9.3 Gaseous
10. Hazardous pollutants include but not limited to:	10.1 Non-Physical hazards such as noise, electricity, heat and cold 10.2 Chemical hazards such as toxic gases, noxious fumes and corrosive liquids 10.3 Radiation hazards, for example, from x-ray machines, high powered lasers, radioactive materials 10.4 Biological hazards such as specimen containers carrying potentially infected materials and bacteria and viruses from air conditioning systems
11. Safety plans include but not limited to:	11.1 Fire plan 11.2 Evacuation plan 11.3 Emergency Plan 11.4 Drill plan 11.5 First-Aid Plan
12. Safety standards include but not limited to:	12.1 OSHA, 2007 12.2 OHSAS 18001 for occupational health and safety management 12.3 ISO 14001 for Environmental Management System
13. Manuals include but not limited to:	13.1 Fire Extinguishers 13.2 Flame Detectors 13.3 Flame monitors 13.4 Flame Safeguard 13.5 Gas Detectors 13.6 Fire Sprinkler Systems

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Variable	Range
	13.7Air Horn
14. Safety equipment include but not limited to*:*	14.1Fire Extinguishers 14.2Flame Detectors 14.3 Flame monitors 14.4Flame Safeguard 14.5Gas Detectors. 14.6Fire Sprinkler Systems. 14.7Air Horn. 14.8Smoke detectors 14.9Heat detector
15. Utilities include but not limited to*:*	15.1. Compressed air 15.2. Inert Gas 15.3. Fuel 15.4. Water (Process water, Potable water, Cooling water, Hot water, Boiler feed water, Fire hydrant, and Waste water) 15.5. Steam (Low pressure, High pressure). 15.6. Electricity. 15.7. Natural gas. 15.8. Manufactured gas. 15.9. Refrigerants. 15.10. Thermal Fluids

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REQUIRED KNOWLEDGE AND UNDERSTANDING

The individual needs to demonstrate knowledge and understanding of:

1. Organizational Context (Knowledge of the Company/Organization and its processes) The individual on the job needs to know and understand:	
1.1	Company's policies on health, safety and environmental procedures at the Workplace
1.2	Company's reporting structure
1.3	Company's documented policies
1.4	Company's documentation policy
1.5	Occupational health, safety and environmental standards
1.6	Escalation protocol for reporting identified issues, hazards and breakage
2**. Technical Knowledge** **The individual on the job needs to know and understand**:	
2.1	Inspection procedures
2.2	The purpose and usage of ***Personal Protective Equipment***.

	Different types of cleaning materials
2.3	Administration of first aid at workplace.
	Methods of identifying risks and hazards
2.4	Reporting procedure for signs of damage and potential ***hazards***.
2.5	Methods to minimize process risks.
2.6	Safe handling of chemicals.
2.7	Material handling procedure.
2.8	Precautionary activities to be followed for work place safety.
2.9	Safety plans to be followed in case of emergencies.
2.10	Waste disposal, treatment and equipment.
2.11	The range of signs and symbols used for the warning of workplace hazards and prohibited practices
2.12	Methods to minimize environmental ***hazards***
	Carrying out Job Risk assessment

FOUNDATION SKILLS

The individual needs to demonstrate the following additional skills:	
• Observational • Critical thinking • Management • Interpersonal • Report writing	• Analytical • Communication • Problem solving • Computer Proficiency • Creative thinking

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EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical Aspects of Competency	***Assessment requires evidence that the learner:*** 1.1 Implemented housekeeping for the production area according to SOP 1.2 Carried out job risk assessment according to SOP 1.3 Worn appropriate PPE during cleaning according to SOP 1.4 Treated/disposed waste according to SOP 1.5 Verified safety equipment functionality and recorded according to safety standards 1.6 Monitored environmental pollutions
2. Resource Implications	***The following resources must be provided:*** 2.1 A production line equipment in line with the process. 2.2 Cleaning materials & equipment 2.3 Personal Protective Equipment 2.4 Waste and hazards monitoring equipment 2.5 Safety equipment
3. Methods of Assessment	Competency may be assessed through: 3.1 Observation with the use of checklists

	3.2 Interviewing to test knowledge 3.3 Written tests 3.4 Portfolio Assessment 3.5 Interview 3.6 Situation Analysis 3.7 Demonstration and oral questioning
4. Context of Assessment	Competency may be assessed individually in an actual workplace or in work-simulated conditions within accredited institutions.
5. Guidance information for assessment	This unit may be assessed on an integrated basis with others within this occupational sector.

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PERFORM PROCESS QUALITY CONTROL

UNIT CODE: ENG/OS/CE/CR/2/6

UNIT DESCRIPTION

This unit covers the knowledge, understanding and skills required for a Chemical Engineering Technician to perform Quality Control Procedures in a workplace where chemical production activities are performed. It includes implementing of quality management systems, conducting materials and equipment inspection, performing Process parameters adjustments, quarantining non-conformities, carrying out root cause analysis and performing process statistical analysis.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Develop/identify process QC standards	1.1 Check the availability of process QC standard according to SOP. 1.2 Research on the QC process according to SOP 1.3 Determine methodology for QC standard according to SOP 1.4 Develop process QC standard according to Quality management system (QMS) 1.5 Obtain approval of developed QC standards according SOP 1.6 Install approved QC standard according to SOP
2. Train staff and sensitize stakeholders for quality management systems	2.1 Process members are trained on how to implement quality management systems according to QMS 2.2 Staff are trained on why to implement quality management according to QMS. 2.3 Stakeholders are sensitized on importance of QMS according to QMS standards. 2.4 Process members are trained on the usage of ***quality documents*** according to quality standards. 2.5 Process members are trained on participation and supporting quality audit according to **quality standards.** 2.6 Process members are trained on how to deliver

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ELEMENT These describe the key outcomes which make up workplace function	PERFORMANCE CRITERIA These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
	quality work on time according to Quality Standards
3. Inspect incoming materials and consumables	2.1 ***Materials*** and products are inspected as per ***production data*** according to Quality Standards 2.2 Materials and products are checked at regular intervals according to the quality standards 2.3 Any variance in materials are recorded and escalated according to the quality standards.
4. Collect samples (Incoming materials, in process materials & finished product).	3.1 Sample materials & products are tested according to ***Standard Operating Procedures (SOP)*** 3.2 Samples are identified according to SOP 3.3 Reference samples are stored for future/further testing according to SOP 3.4 ***Equipment for testing*** is identified according to SOP 3.5 Tests are carried out according to SOP 3.6 Data is maintained according to SOP
5. Verify equipment functionality	4.1 Equipment is tested to carry out optimum production activities according to SOP 4.2 Process equipment is monitored and parameters recorded to obtain optimal performance according to SOP 4.3 Preventive maintenance is coordinated with maintenance teams according to SOP
6. Perform Process parameters adjustments	5.1 ***Critical parameters*** for the ***utilities*** are set according to the s SOP 5.2 Critical parameters for the ***production machines*** are set according to the SOP 5.3 ***Process parameters*** are adjusted according to the SOP
7. Analyze collected samples	6.1 Obtain collected data according to SOP 6.2 Clean raw data according to SOP 6.3 Obtain tools for analysis according to SOP 6.4 Analyze data according to SOP 6.5 Report data according to requirement.
8. Maintain analyzed samples records.	7.1 Obtain analysed records 7.2 File records 7.3 Store records

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ELEMENT These describe the key outcomes which make up workplace function	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
9. Identify non-conforming products	8.1 Obtain data from quality control according to SOP 8.2 Segregate non-conforming products according to SOP 8.3 Label non-conforming products according to quality standards. 8.4 Document non-conforming products according to SOP.
10. Quarantine non-conforming products.	10.1 Non-conformities are identified and removed from the process flow according to Quality Standards 10.2 Non-conformities are labelled and stored in a secure area according to the quality standards 10.3 Non-conformities are recorded and reported according to Quality Standards 10.4 Release the finished products according to quality standards
11. Carry out non-conformities root cause analysis.	11.1 Problems are defined according to ***root cause analysis techniques*** 11.2 The information is checked to understand the problem according to root cause analysis technique 11.3 Immediate action is implemented to solve the problem according to root cause analysis technique 11.4 Corrective action is determined to solve the problem according to root cause analysis technique 11.5 The solution for the problem is confirmed and recorded according to quality standards
12. Release finished products.	12.1 Verify the products according to SOP 12.2 Record products according to company policy 12.3 Obtain approval according to SOP 12.4 Release records according to SOP
13. Perform process statistical analysis.	13.1 Data is collected from the process according SOP's 13.2 Data from the process is analysed according to

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ELEMENT These describe the key outcomes which make up workplace function	PERFORMANCE CRITERIA These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
	SOP's 13.3 Data from the process is reported according to SOP's

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variable	Range
1. Quality Standards include but not limited to:	1.1 Customer specifications 1.2 ISO 9000 1.3 ISO 9001 1.4 ISO 17025
2. Quality Documents include but not limited to:	2.1 The quality objectives 2.2 Process description documentation 2.3 Resources and facilities required 2.4 Verification and validation, monitoring, inspection/test plans and criteria for acceptance 2.5 Records for demonstrating confidence of conformity of processes 2.6 Organization instructions
3. Production data include but not limited to:	3.1 Name. 3.2 Quality 3.3 Quantity 3.4 Production date 3.5 Expiry date
4. Standard Operating Procedures (SOP) include but not limited to:	4.1 Sampling instructions. 4.2 Operation manuals. 4.3 Testing procedures 4.4 Data record format. 4.5 Inspection report. 4.6 Nonconformities report. 4.7 Company Instructions. 4.8 Packaging specification.
5. Testing Equipment include but not limited to:	5.1 Spectroscopy systems, such as MS, atomic absorption, atomic emission, Ultra Violet, X-ray, and Raman

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Variable	Range
	spectroscopy 5.2 Gas chromatography and liquid chromatography systems 5.3 Process analysers including refractometers, rheometers, viscometers, thermal analysers, and calorimeters.
6. Critical process parameters include but not limited to:	6.1 Temperature 6.2 Pressure. 6.3 Catalysis 6.4 Rotation speed 6.5 PH. 6.6 Agitation 6.7 Cooling rate 6.8 Flow rates 6.9 Levels 6.10 Viscosity 6.11 Vibrations
7. Equipment/Production machines include but not limited to:	7.1 Reactor 7.2 Filters 7.3 Driers 7.4 Separators 7.5 Heat exchangers 7.6 Pumps 7.7 Variable speed drives 7.8 Safety equipment 7.9 Conveyer belts. 7.10 Date code machine. 7.11 Packaging machine 7.12 Diagnostic equipment. 7.13 Testing equipment. 7.14 Labelling machine.
8. Utilities include but not limited to:	8.1 Compressed air. 8.2 Inert Gas. 8.3 Fuel. 8.4 Water (Process water, Potable water, Cooling water, Hot water, Boiler feed water, Fire water, and Waste water) 8.5 Steam (wet/ dry/superheated). 8.6 Electricity. 8.7 Natural gas. 8.8 Manufactured gas

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Variable	Range
	8.9 Refrigerants. 8.10 Thermal Fluids.
9. Root cause analysis techniques include but not limited to:	9.1 5 Ws (What, why, when, where, who) 9.2 Fish bone diagram 9.3 Cause effect diagram
10. Materials include but not limited to:	10.1 Raw materials 10.2 In process materials 10.3 Packaging materials 10.4 Process consumable materials 10.5 Process waste 10.6 Catalysts

REQUIRED KNOWLEDGE AND UNDERSTANDING

The individual needs to demonstrate knowledge and understanding of:

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1. Organizational Context (Knowledge of the Company/Organization and its processes) **The individual on the job needs to know and understand:**	
1.1	Company's policies on health, safety and environmental procedures at the workplace
1.2	Standard operating procedures of the production unit
1.3	Policies and procedures for conducting/participating in audits
1.4	Legal and regulatory frameworks relevant to the production work
1.5	Quality assurance methods approved by the company
1.6	Escalation protocol for reporting identified issues during quality checks.
1.7	Documentation
2. Technical Knowledge **The individual on the job needs to know and understand:**	
2.1	Different quality management systems (ISO-9000, ISO-14001, OHSAS-18000)
2.2	Materials inspection procedures
2.3	Different techniques/inspection methods used to identify defects
2.4	Standard method of sampling and testing
2.5	Use of testing instruments
2.6	Diagnoses of production line equipment
2.7	Diagnoses of testing instruments
2.8	Maintaining master samples
2.9	Confirming status of plant/equipment
2.10	Preventive maintenance

2.11	Adjustment of parameters for the utilities & production machine
2.12	Identification and isolation of non-conformities
2.13	Root cause analysis.
2.14	Statistical analysis.
2.15	Composition/requirements of the product manufactured
2.16	Characteristics of the product/material
2.17	Effect of inaccurate measuring and testing instruments and equipment.

FOUNDATION SKILLS

The individual needs to demonstrate the following foundation skills:	
• Management • Observational • Interpersonal • Analytical chemistry	• Communication • Analytical Thinking • Computer Proficiency

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical Aspects of Competency	***Assessment requires evidence that the learner:*** 1.1 Trained process members on how to implement quality management system 1.2 Collected and inspected samples and verified their validity 1.3 Verified equipment functionality and recorded according to quality standards 1.4 Adjusted the equipment parameters according to SOP. 1.5 Identified and isolated the non-conformities according to quality standards 1.6 Carried out root cause analysis 1.7 Collected process data to perform process statistical analysis
2. Resource Implications	***The following resources must be provided:*** 2.1 A production line equipment in line with the process. 2.3 Consumables for process, including reagents, chemicals, sample containers and spare parts 2.4 Quality control system and its documentation 2.5 Testing equipment and its accessories 2.6 Process control equipment
3. Methods of Assessment	**Competency may be assessed through:** 3.1 Observation with the use of checklists 3.2 Interviewing to test knowledge 3.3 Written tests 3.4 Portfolio Assessment 3.5 Interview

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	3.6 Situation Analysis 3.7 Demonstration and oral questioning
Context of Assessment	Competency may be assessed individually in an actual workplace or in work-simulated conditions within accredited institutions
Guidance information for assessment	This unit may be assessed on an integrated basis with others within this occupational sector

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PERFORM PROCESS CONTROL AND OPTIMIZATION

UNIT CODE: ENG/OS/CE/CR/3/6

UNIT DESCRIPTION

This unit covers the knowledge, understanding and skills required for a Chemical Engineering Technician to manage process utilities during operations in a workplace where chemical production activities are performed. It includes checking measuring instruments functionality, monitoring utilities consumptions, identifying and fixing utilities losses, and implement energy saving initiatives.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Confirm measuring instruments functionality	1.1 ***Measuring instruments*** are checked and recorded before and during process to obtain optimum performance according to ***Standard Operating Procedures (SOP)*** 1.2 Defective measuring instruments are identified, isolated and replaced according to SOP 1.3 Measuring instruments are calibrated periodically according to SOP 1.4 The accuracy of measuring instruments is verified using reference standards/materials according to SOP.
2. Monitor utilities consumption	2.1 The ***critical parameters*** are set according to SOP 2.2 ***Utilities*** are recorded and monitored during process to obtain optimum performance according to SOP 2.3 Maintenance teams are coordinated for preventive maintenance according to SOP
3. Identify utility losses	3.1 Check utility functionality according to SOP. 3.2 Check utility performance according to SOP 3.3 Identify utility losses according to manufacturer's index.
4. Eliminate utility losses	4.1 Immediate actions are taken to correct faults in utilities according to SOP 4.2 Maintenance teams are coordinated to fix defective units according to SOP
5. Optimize Energy	5.1 Energy saving utilities are identified according to

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ELEMENT These describe the key outcomes which make up workplace function	PERFORMANCE CRITERIA These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
consumptions	SOP's 5.2 Implement and standardize the ***energy saving initiatives*** 5.3 The use of utilities is optimized according to SOP 5.4 Utilities bills are analyzed to determine energy performance parameters according to ISO 50001 (Energy management systems)

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance

Variable	Range
1. Measuring instruments include but not limited to:	1.1 Flow meter 1.2 Level indicator 1.3 Level sensors 1.4 Thermometer 1.5 Pressure gauges 1.6 Hygrometer 1.7 Safety and Miscellaneous Sensors 1.8 Analytical Instruments 1.9 Viscometers 1.10 Vacuum gauges 1.11 Respective transmitters
2. Standard Operating Procedures (SOP) include but not limited to:	2.1 Sampling instructions 2.2 Operation manuals 2.3 Testing procedures 2.4 Data record format 2.5 Handling of non-conformities 2.6 Packaging specification 2.7 Exposure limits
3. Critical parameters include but not limited to:	3.1 Temperature 3.2 Pressure 3.3 pH 3.4 Cooling rate
4. Utilities include but not	4.1 Compressed air

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Variable	Range
limited to:	4.2 Inert Gas 4.3 Fuel 4.4 Water (Process water, Potable water, Cooling water, Hot water, Boiler feed water, fire hydrant, and waste water). 4.5 Steam (Low pressure, High pressure) 4.6 Electricity 4.7 Natural gas 4.8 Manufactured gas 4.9 Refrigerants 4.10Thermal Fluids
5. Various pipe colours include but not limited to:	5.1 Compressed air Blue 5.2 Inert Gas light blue + Yellow. 5.3 CO2 Black 5.4 Fuel Yellow + White. 5.5 Cooling water Dark green+ Light green 5.6 Process water Black + Blue 5.7 Potable water Blue + White 5.8 Fire hydrant Red 5.9 Waste water Green + Black 5.10Utility water Dark green + White 5.11Steam Silver 5.12Electricity Red 5.13Natural gas Yellow 5.14Manufactured gas Yellow 5.15Refrigerants Blue 5.16Thermal Fluids Red
6. Energy saving initiatives include but not limited to:	6.1 Use of Energy saving bulbs 6.2 Use of Electronic timers are used according to energy saving instructions 6.3 Switching off unused equipment 6.4 Sealing of leakages 6.5 Correcting faults 6.6 Pinch technology

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REQUIRED KNOWLEDGE AND UNDERSTANDING

The individual needs to demonstrate knowledge and understanding of:

1. Organizational Context (Knowledge of the Company/Organization and its processes) **The individual on the job needs to know and understand:**

1.1	Organization's vision and strategy
1.2	Knowledge of company instructions and the SOP
1.3	Different quality management systems (ISO-9000, ISO-14001, OHSAS-18000 etc.).
1.4	Documentation
1.5	Escalation protocol for reporting identified issues during checks
1.6	Standard Operating Procedures
2. Technical Knowledge **The individual on the job needs to know and understand:**	
2.1	Monitoring, measuring and testing instruments e.g. diagnosis, calibration, routine maintenance operation
2.2	Knowledge of process parameters
2.3	Common causes of variation and corrective action required
2.4	Basic operation of equipment used to generate utilities eg boilers, chillers, compressors, cooling towers, air compressors
2.5	Concepts of energy management systems
2.6	Occupational hazards and safety precautions of the work
2.7	Various pipe colours
2.8	Knowledge primary sensing elements

FOUNDATION SKILLS

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The individual needs to demonstrate the following foundation skills:	
• Management • Observation • Troubleshooting • Team work	• Communication • Analytical Thinking • Computer Proficiency

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical Aspects of Competency	***Assessment requires evidence that the learner:*** 1.1 Checked and calibrated measuring instrument and recorded it in appropriate format according to SOP. 1.2 Monitored utilities consumptions and recording according to SOP 1.3 Identified and fixed utility losses 1.4 Implemented energy saving initiatives 1.5
2. Resource Implications	***The following resources must be provided:*** 2.1 Equipment used for generating utilities e.g. boilers, chillers, compressors, cooling towers, air compressors 2.2 Measuring and testing instruments

	2.3 Calibration standard
3. Methods of Assessment	**Competency may be assessed through:** 3.1 Observation with the use of checklists 3.2 Interviewing to test knowledge 3.3 Written tests 3.4 Portfolio Assessment 3.5 Interview 3.6 Situation Analysis 3.7 Demonstration and oral questioning
4. Context of Assessment	Competency may be assessed individually in an actual workplace or in work-simulated conditions within accredited institutions.
5. Guidance information for assessment	This unit may be assessed on an integrated basis with others within this occupational sector.

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PREPARE PROCESS RAW MATERIALS

UNIT CODE: ENG/OS/CE/CR/4/6

UNIT DESCRIPTION

This unit covers the knowledge, understanding and skills required for a Chemical Engineering Technician to prepare raw materials in a workplace where chemical production activities are performed. It includes preparing production sheet, ordering the materials needed inspecting raw materials and feeding them to the production process.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Prepare Production schedule	1.1 ***Raw materials*** are defined according to ***Standard Operating Procedures (SOP)***. 1.2 Prepare production order according (SOP) 1.3 Raw materials are received according to SOP
2. Develop Production procedure	2.1 Check the availability of production procedure according to SOP. 2.2 Identify production process required according to SOP 2.3 Arrange processes in a logical sequence according to SOP 2.4 Obtain approval of developed production procedure according SOP 2.5 Install/adopt approved production procedure according to SOP
3. Conduct raw material inspection	3.1 Raw materials are checked against ***production data*** according to SOP 3.2 Impurities are removed from raw materials according to SOP 3.3 Any discrepancies in materials are recorded and reported to according to SOP 3.4 Non-conforming materials are prevented from use according to SOP
4. Weigh and record Production RM.	4.1 ***Personal protection equipment (PPE)*** is worn according to ***safety standards*** 4.2 Quantity of raw materials is checked to comply with process requirements according production data

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ELEMENT These describe the key outcomes which make up workplace function	PERFORMANCE CRITERIA These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
	4.3 Damage, loss or contamination of materials are reported according to SOP's 4.4 Record quantity of raw materials according to production data.
5. Condition the raw materials	5.1 Inspect raw material according to SOP 5.2 Determine type of conditioning according to raw material requirement. 5.3 Condition raw material according to SOP
6. Feed raw materials	***6.1 Equipment*** is checked for safety and functionality according to SOP ***6.2*** Materials are prepared and fed according to SOP 6.3 Material handling techniques is used in a safe method to keep wastage to a minimum according to SOP

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

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Variable	Range
1. Raw materials include but not limited to:	1.1 Incoming raw materials 1.2 In process raw materials 1.3 Consumables 1.4 Waste 1.5 Side streams
2. Production Data include but not limited to:	2.1 Type 2.2 Quality 2.3 Quantity 2.4 Ratio
3. Standard Operating Procedures (SOP) include but not limited to:	3.1 Sampling instructions 3.2 Operation manuals 3.3 Inspection procedures 3.4 Data record formats 3.5 Out of specification standards 3.6 Company Instructions 3.7 Packaging specification 3.8 Standard operating temperature and pressure

Variable	Range
4. Personal protective equipment include but not limited to:	6.4 Helmet 6.5 Gloves 6.6 Face mask and Goggles 6.7 Protective clothing 6.8 Foot protection 6.9 Hearing protection 6.10 Respiratory protection
7. Equipment include but not limited to:	5.1 Reactor 5.2 Conveyer belts 5.3 Testing equipment 5.4 Weighing scales 5.5 Feeding equipment
8. Safety standard include but not limited to:	6..1 Material handling SOP's 6.2 OHSAS 18001 for occupational health and safety management 6.3 ISO 14001 for environmental management

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REQUIRED KNOWLEDGE AND UNDERSTANDING

The individual needs to demonstrate knowledge and understanding of:

1. Organizational Context (Knowledge of the Company/Organization and its processes) **The individual on the job needs to know and understand:**	
1.1	Company's Quality policy and the Standard Operating Procedures (SOP)
1.2	Different quality management systems (ISO-9000, ISO-14001, OHSAS-18000).
1.3	Production norms of the company
1.1	Organization's policy, vision and strategy
1.2	Knowledge of company instructions and the SOP
1.3	Different quality management systems (ISO-9000, ISO-14001, OHSAS-18000 etc.)
	Documentation
2. Technical Knowledge **The individual on the job needs to know and understand:**	
2.1	Preparation of production order
2.2	Material handling procedure
2.6	Safety standards and procedures
2.8	Trouble shooting
2.10	Raw material Inspection procedures
2.12	Use of material handling equipment eg weighing, grinding, blending and mixing

1. Organizational Context (Knowledge of the Company/Organization and its processes) The individual on the job needs to know and understand:	
	equipment

FOUNDATION SKILLS

The individual needs to demonstrate the following foundation skills:	
• Problem solving • Observational skills • Management skills • Computer Proficiency	• Communication skills • Analytical Thinking • Decision making skills • Planning and organising skills

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance Criteria, required skills and knowledge and range.

1. Critical Aspects of Competency	***Assessment requires evidence that the learner:*** 1.1 Prepared production order for ***material*** needed 1.2 Inspected the raw materials and recorded the results according to SOP 1.3 Confirmed quantities of raw materials and recorded according to SOP 1.4 Loaded process materials according to SOP 1.5 Handled the materials according to SOP's
2 Resource Implications	***The following resources must be provided:*** 2.1 Special area for preparing ***raw materials*** 2.3 Sampling tools 2.4 Materials preparation equipment (grinding, blending, mixers, scale etc.)
3 Methods of Assessment	**Competency may be assessed through:** 3.1 Observation with the use of checklists 3.2 Interviewing to test knowledge 3.3 Written tests 3.4 Portfolio Assessment 3.5 Interview 3.6 Situation Analysis 3.7 Demonstration and oral questioning
4 Context of Assessment	Competency may be assessed individually in an actual workplace or in work-simulated conditions within accredited institutions.
5 Guidance information for assessment	This unit may be assessed on an integrated basis with others within this occupational sector.

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OPERATE PROCESS EQUIPMENT

UNIT CODE: ENG/OS/CE/CR/5/6

Unit description

This unit covers the knowledge, understanding and skills required for a Chemical Engineering Technician to operate process equipment in a workplace where chemical production activities are performed. It includes preparing and starting process equipment carrying out process quality control checks & records, monitoring, packing and storing finished product.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Clean process equipment	1.1 ***PPE*** is provided according to the ***Safety standards*** 1.2 Necessary cleaning material and equipment are identified according to SOP. 1.3 Area to be cleaned are identified according to SOP 1.4 Clean the equipment according to SOP.
2. Inspect process equipment	2.1 ***Process equipment*** is inspected at the beginning of the production according to SOP 2.2 Testing procedures is performed to ensure the process equipment work optimally according to SOP 2.3 Maintenance teams are coordinated for preventive maintenance according to SOP
3. Operate process equipment	3.1 Pre-start checks are conducted according to SOP 3.2 ***Process parameters*** are set according to SOP 3.3 Process equipment is started to perform warm up according to SOP 3.4 ***Raw materials*** are loaded according to SOP 3.5 Labelling and segregation of material and finished products are carried out according to SOP
4. Monitor process parameters	4.1 Measure process parameters according to SOP 4.2 Recording the process parameters in the production log sheet 4.3 Report to the supervisor according to SOP

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ELEMENT These describe the key outcomes which make up workplace function	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
5. Carry out process quality Control checks	5.1 Equipment checks are performed and recorded according to SOP's 5.2 Products and materials are checked according to quality standards ***5.3*** Non-conformities are identified according to ***quality standards*** 5.4 Causes of non-conformities are identified according to quality standards 5.5 Corrective actions are carried out according to quality standards 5.6 Results are recorded in quality documents according to quality standards
6. Maintain production records	6.1 Obtain the records according to SOP 6.2 File the records according to SOP 6.3 Store records according to SOP
7. Maintain workstation cleanliness	7.1 ***PPE*** is provided according to the ***Safety standards*** 7.2 Necessary cleaning material and equipment are identified according to SOP. 7.3 Inspect the workstation according to SOP 7.4 Areas to be cleaned are identified according to SOP 7.5 Clean the workstation according to SOP.
8. Pack the finished product	8.1 Select ***packaging materials*** according to ***SOP*** 8.2 Package the products according to SOP 8.3 Non-conforming products are segregated according to quality standards 8.4 Packaged Products are recorded according to SOP
9. Transfer processed product.	9.1 Storage locations are identified according to SOP 9.2 Packaged products are transferred (store or dispatch) to designated location according to SOP 9.3 Records are maintained according to quality standards

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RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variable	Range
1. Process equipment Includes but not limited to	1.1 Reactor 1.2 Conveyer belts 1.3 Date code machine 1.4 Packing machine 1.5 Diagnostic equipment 1.6 Testing equipment 1.7 Labelling machine 1.8 Filters 1.9 Driers 1.10 Compressors 1.11 Refrigeration equipment 1.12 Pumps
2. Standard Operating Procedures (SOP) includes but not limited to:	2.1 Sampling instructions 2.2 Operation manuals 2.3 Cleaning methods 2.4 Testing procedures 2.5 Data record format 2.6 Inspection report 2.7 Out of specification procedure 2.8 Company Instructions 2.9 Packaging specification 2.10 Storage and delivery requirements
3. Materials Includes but not limited to:	3.1 Incoming materials 3.2 In process materials 3.3 Packaging materials 3.4 Process consumables
4. Process parameters Includes but not limited to:	4.1 Temperature 4.2 Pressure 4.3 Flow rate 4.4 Rotation speed 4.5 pH 4.6 Agitation 4.7 Cooling rate
5. Quality standards Includes but not limited to:	5.1 Customer specifications 5.2 ISO 9001 5.3 ISO17025
6. Safety standards Includes but not limited to:	6.1 Operation SOP's 6.2 OSHA 2007 6.3 OHSAS 18001 for occupational health and safety management. 6.4 ISO 14001 for environmental management.

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Variable	Range
7. Personal protective equipment Includes but not limited to:	7.1 Helmet 7.2 Gloves 7.3 Face mask and Goggles 7.4 Protective clothing 7.5 Foot protection 7.6 Hearing protection 7.7 Respiratory protection
8. Packaging materials Includes but not limited to:	8.1 Paper/Paperboard/Fibreboard 8.2 HDPE (High-density polyethylene) and PET (polyethylene terephthalate) Rigid Packaging 8.3 LDP (Low-density polyethylene), LLDPE (Linear low-density polyethylene) Flexible Packaging 8.4 Aluminium Packaging 8.5 Glass/Jars

REQUIRED KNOWLEDGE AND UNDERSTANDING

The individual needs to demonstrate knowledge and understanding of:

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1. Organizational Context (Knowledge of the Company/Organization and its processes) **The individual on the job needs to know and understand:**	
1.1	Company's Quality policy and the Standard Operating Procedures (SOP)
1.2	Different quality management systems (ISO-9000, ISO-14001, OHSAS-18000).
1.3	Production norms of the company
1.4	Organization's policy, vision and strategy
1.5	Knowledge of company instructions and the SOP
1.6	Different quality management systems (ISO-9000, ISO-14001, OHSAS-18000 etc.)
1.7	Documentation
2. Technical Knowledge **The individual on the job needs to know and understand:**	
2.1	Measuring units and methods of performing calculations
2.2	Reference standards/materials
2.3	Operation of equipment
2.4	Process parameters (e.g. time, temperature, pressure)
2.8	Material handling
2.10	Packaging specifications
2.13	Handling of non-conformities

FOUNDATION SKILLS

The individual needs to demonstrate the following foundation skills:	
• Management skills • Problem solving • Observational skills • Computing proficiency • Trouble shooting	• Communication skills • Analytical Thinking • Interpersonal skills • Decision Making skills

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance Criteria, required skills and knowledge and range.

1. Critical Aspects of Competency	***Assessment requires evidence that the learner:*** 1.1 Inspected and tested the process equipment and recorded according to SOP 1.2 Set the ***Process parameters*** and operated according to ***SOP***. 1.3 1.4 Products, materials and equipment are checked according to SOP's 1.5 Identified and recorded non-conformities according to SOP 1.6 Packed and transferred finished product according SOP's 1.7 Maintained housekeeping according to SOP
2. Resource Implications	***The following resources must be provided:*** 2.1 A production line that is equipped with process equipment 2.3 Consumables for process e.g. packaging materials, cleaning materials, sample containers and spare parts 2.5 Testing equipment and its accessories 2.6 ***Personal protective equipment (PPE)*** 2.7 Tools
3. Methods of Assessment	Competency may be assessed through: 3.1 Observation with the use of checklists 3.2 Interviewing to test knowledge 3.3 Written tests 3.4 Portfolio Assessment 3.5 Interview 3.6 Situation Analysis 3.7 Demonstration and oral questioning
4. Context of Assessment	Competency may be assessed individually in an actual workplace or in work-simulated conditions within accredited institutions.
5. Guidance information for assessment	This unit may be assessed on an integrated basis with others within this occupational sector

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MAINTAIN PRODUCTION LINE EQUIPMENT

UNIT CODE: ENG/OS/CE/CR/5/6

UNIT DESCRIPTION

This unit covers the knowledge, understanding and skills required for a Chemical Engineering Technician to maintain production line equipment in a workplace where chemical production activities are performed. It includes carrying out equipment safety procedure, inspecting production line equipment, carrying out diagnostic analysis, maintaining mechanical equipment, maintaining process control instruments, escalating equipment/instruments breakdown and keeping maintenance logs.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Carry out equipment safety procedure	1.1 Safety procedures for handling equipment are compiled according to ***safety standards*** 1.2 ***Personal protective equipment (PPE)*** is used according to safety standards 1.3 Eequipment and tools are handled according to safety standards 1.4 Parts of the production line equipment are checked and preventive actions are taken according to safety standards
2. Inspect production line equipment	2.1 Identify process ***equipment*** & ***instruments*** according to ***Standard Operating Procedures (SOP)*** 2.2 Inspect process equipment and instrument according to SOP.
3. Carry out diagnostic analysis	3.1 Diagnostic techniques and tools to locate faults are selected, used and applied according to SOP 3.2 The causes of the faults are investigated and established according to SOP 3.3 Details on the extent, location of the faults and preventive action taken and recorded according to SOP
4. Maintain process and utilities equipment.	4.1 Production line ***equipment*** are checked according to the SOP 4.2 Select tools and work methods according to SOP 4.3 Maintenance and repairs are carried out according to SOP 4.4 Final checks are carried out to make ensure that the

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ELEMENT These describe the key outcomes which make up workplace function	PERFORMANCE CRITERIA These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
	equipment is safe and effective according to safety standards 4.5 Equipment maintenance records are completed according to SOP
5. Escalate major equipment breakdown	5.1 Major problems are escalated according to SOP 5.2 Breakdowns are escalated within stipulated time according to SOP 5.3 Records of escalated breakdowns are maintained according to SOP
6. Document equipment maintenance records.	6.1 Maintenance logs are maintained according to SOP 6.2 Maintenance records are kept according to SOP

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

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Variable	Range
1. Safety standards include but not limited to:	1.1 Maintenance SOP's 1.2 OSHA,2007 1.3 OHSAS 18001 for occupational health and safety management. 1.4 ISO 9001 for Quality Management System
2. Personal protective equipment (PPE) include but not limited to:	2.1 Helmet 2.2 Gloves 2.3 Face mask and Goggles 2.4 Protective clothing 2.5 Foot protection 2.6 Hearing protection 2.7 Respiratory protection
3 Process instruments and equipment include but not limited to:	3.1 Reactor 3.2 Conveyer belts 3.3 Date Code machine 3.4 Packaging machine 3.5 Diagnostic equipment 3.6 Testing equipment 3.7 Labelling machine

Variable	Range
	3.8 Flow meter. 3.9 Level indicator. 3.10Thermometer. 3.11Pressure gauge. 3.12Hygrometer. 3.13Safety and Miscellaneous Sensors. 3.14 Analytical Instrumentation
4 Standard Operating Procedures include but not limited to:	4.1 Operation manuals 4.2 Inspection procedure 4.3 Testing procedures 4.4 Data record format 4.5 Diagnostic analysis procedure 4.6 Organisation procedures. 4.7 Manufacturer's instructions

REQUIRED KNOWLEDGE AND UNDERSTANDING

The individual needs to demonstrate knowledge and understanding of:

1. Organizational Context (Knowledge of the Company/Organization and its processes) **The individual on the job needs to know and understand:**	
1.1	Company's Quality policy, vision and strategy
1.2	Different quality management systems (ISO-9000, ISO-14001, OHSAS-18000).
1.3	Different quality management systems (ISO-9000, ISO-14001, OHSAS-18000 etc.)
1.4	Documentation
1.5	Standard Operating Procedures
2. Technical Knowledge **The individual on the job needs to know and understand:**	
2.1	Environmental health and safety standards (EHS)
2.2	Escalating accidents incidents and problems
2.3	Equipment safety diagnosis
2.4	The range of tools, equipment and materials needed for maintenance
2.5	The manufacturer's equipment manual
2.6	Basic mechanics
2.7	Basic electricity
2.8	Instrumentation and control

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FOUNDATION SKILLS

The individual needs to demonstrate the following foundation skills:

• Time management • Problem solving • Observational skills • Computer proficiency	• Communication skills • Analytical Thinking • Interpersonal skills • Decision Making

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance Criteria, required skills and knowledge and range.

1	Critical Aspects of Competency	***Assessment requires evidence that the learner:*** 1.1 Checked the safety of process equipment and took the preventive actions according to safety standards 1.2 Inspected the functionality of process equipment, measuring instruments, and carried out diagnostic analysis according to (SOP). 1.3 Escalated equipment/instruments breakdown 1.4 Maintained equipment maintenance logs 1.5 Maintained housekeeping according to SOP
2	Resource Implications	***The following resources must be provided:*** 2.1 A production line that is equipped with process equipment 2.2 Personal Protective Equipment 2.3 Tools
3	Methods of Assessment	**Competency may be assessed through:** 3.1 Observation with the use of checklists 3.2 Interviewing to test knowledge 3.3 Written tests 3.4 Portfolio Assessment 3.5 Interview 3.6 Situation Analysis 3.7 Demonstration and oral questioning
4	Context of Assessment	Competency may be assessed individually in an actual workplace or in work-simulated conditions within accredited institutions
5	Guidance information for assessment	This unit may be assessed on an integrated basis with others within this occupational sector.

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AUDIT PRODUCTION PROCESS

UNIT CODE: ENG/OS/CE/CR/6/6

UNIT DESCRIPTION

This unit covers the knowledge, understanding and skills required for a Chemical Engineering Technician to implement continuous process improvement initiatives in a workplace where chemical production activities are performed. It includes analyzing process data to optimize process units, improving overall equipment efficiency, reducing process waste, carrying out process innovation to facilitate new product development, identifying training needs and documenting continuous improvement initiatives.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Analyse process data	1.1 Process data is recorded according to ***standard operating procedure (SOP)***. 1.2 Process data is analysed using format according to SOP. 1.3 Deviations are investigated and action taken to optimise process units according to SOP 1.4 Analysed data and investigation findings are documented and reported according to SOP
2. Improve equipment efficiency	2.1 Equipment is checked for optimal functionality according to SOP 2.2 ***Equipment performance data*** are recorded according to SOP 2.3 Performance data is analyzed and action taken to improve equipment efficiency
3. Optimize production process	3.1 Analyze process and product data according to production output. 3.2 Analyze equipment performance according to SOP 3.3 Determine optimum conditions according to production requirements. 3.4 Obtain approval according to company procedures. 3.5 Optimize the process according to SOP.
4. Reduce process waste	4.1 Identify types of wastes generated according to EMS standards. 4.2 Quantify process waste generated according to EMS standards. 4.3 Monitor waste generated according to SOP.

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ELEMENT These describe the key outcomes which make up workplace function	PERFORMANCE CRITERIA These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
	4.4 Identify techniques of waste management according to EMS. 4.5 Seek approval according to SOP 4.6 Reduce process waste according to approved techniques.
5. Initiate process innovation	5.1 Opportunities for ***improvements*** are identified according to SOP 5.2 Identified improvements are recorded and implemented according to SOP 5.3 Impact of implemented improvements are monitored and documented according to SOP 5.4 Continuous improvement initiative documents are maintained according to SOP
6. Participate in new product development	6.1 Identify a need for a new product development according to market demand. 6.2 Lease with R&D section according to SOP 6.3 Obtain materials and formulation necessary for new product development according to development standards. 6.4 Obtain approval according to SOP 6.5 Develop new product according to the market needs.
7. Identify production equipment need	7.1 Evaluate the existing equipment and similar equipment in the market according to performance data. 7.2 Identify any abnormalities according to obtained data. 7.3 Report finding according to SOP
8. Identify training needs	8.1 Job evaluation is done to determine the skill requirements according to SOP 8.2 Staff appraisal is done to build skills inventory according to SOP 8.3 Skill gap analysis is carried out to determine the ***training needs*** according to SOP. 8.4 Training needs are documented and reported according to SOP
9. Document continuous improvement initiatives	9.1 Requisite for documentation tools according to SOP 9.2 Identify improvement initiatives according to SOP 9.3 Record the improvements initiatives according to SOP 9.4 Store the documents according to filling system available.

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RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variable	Range
1. Standard Operating Procedure (SOP) include but not limited to:	1.1 Operation manuals 1.2 inspection procedure 1.3 Testing procedures 1.4 Data record format 1.5 Organisation procedures 1.6 Manufacturers manual
2. Equipment performance data include but not limited to:	2.1 Breakdown logs 2.2 Downtime record sheets 2.3 Through put record
3. Improvements include but not limited to:	3.1 Process improvements 3.2 Product improvement 3.3 Waste reduction 3.4 Process automation
4. Training needs include but not limited to:	4.1 Skill gaps 4.2 New method 4.3 New equipment 4.4 Process changes 4.5 New employees

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REQUIRED KNOWLEDGE AND UNDERSTANDING

The individual needs to demonstrate knowledge and understanding of:

1. Organizational Context (Knowledge of the Company/Organization and its processes) **The individual on the job needs to know and understand:**	
1.1	Company's Quality policy, vision and strategy
1.2	Different quality management systems (ISO-9000, ISO-14001, OHSAS-18000).
1.3	Different quality management systems (ISO-9000, ISO-14001, OHSAS-18000 etc.)
1.4	Documentation
1.5	Standard Operating Procedures
1.6	Escalation protocols
2. Technical Knowledge **The individual on the job needs to know and understand:**	
2.1	Workplace procedures and requirements
2.2	Training Needs assessment
2.3	Use of equipment as per standard operating procedure
2.4	World class manufacturing practices

2.5	Emerging trends in chemical engineering
2.6	Research and development methods
2.7	Range of tools, equipment and materials for continuous improvement initiatives
2.8	statistical analysis
2.9	Manufacturer's instructions
2.10	Equipment maintenance logs
2.11	Statistical process control tools e.g. pareto, graphs, charts etc.

FOUNDATION SKILLS

The individual needs to demonstrate the following foundation skills:	
• Management Skills • Problem solving • Observational skills • Computer proficiency	• Communication skills • Analytical Thinking • Interpersonal skills • Decision Making

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance Criteria, required skills and knowledge and range.

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1. Critical Aspects of Competency	***Assessment requires evidence that the learner:*** 1.1 Recorded, analyzed and investigated process performance data according to SOP 1.2 Monitored and recorded process waste generated according to SOP 1.3 Identified, implemented and reported continuous improvement initiatives according to SOP 1.4 Identified training needs according to SOP 1.5 Maintain continuous improvement initiatives documents 1.6 Maintained housekeeping according to SOP
2. Resource Implications	***The following resources must be provided*** 2.1 A production line that is equipped with process equipment 2.2 Research tools 2.3 Opportunities for benchmarking/capacity building 2.4 IT facilitation 2.5 Fully equipped library
3. Methods of Assessment	**Competency may be assessed through:** 3.1 Observation with the use of checklists 3.2 Interviewing to test knowledge 3.3 Written tests 3.4 Portfolio Assessment 3.5 Interview

	3.6 Situation Analysis 3.7 Demonstration and oral questioning
4. Context of Assessment	Competency may be assessed individually in an actual workplace or in work-simulated conditions within accredited institutions.
5. Guidance information for assessment	This unit may be assessed on an integrated basis with others within this occupational sector.

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