

**THE REPUBLIC OF KENYA**

**TVET CURRICULUM DEVELOPMENT, ASSESSMENT AND CERTIFICATION**

**COUNCIL (TVET CDACC)**

**NATIONAL OCCUPATIONAL STANDARDS**

 **FOR**

 **MECHANICAL PLANT TECHNICIAN**

**LEVEL 5**



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, Vision 2030 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 of Kenya 2010 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 these

Occupational Standards were developed for the purpose of developing a competency-based curriculum for Mechanical Plant Technician. These Occupational Standards will also be the bases for assessment of an individual for competence certification. It is my conviction that these Occupational Standards will play a great role towards development of competent human resource for the Mechanical Engineering sector’s growth and 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 labor force.

The TVET Curriculum Development, Assessment and Certification Council (TVET CDACC), in conjunction with Mechanical Plant Sector Skills Advisory Committee (SSAC) have developed these Occupational Standards for Mechanical Plant technician. These standards will be the bases for development of competency-based curriculum for Mechanical Plant Technology Level 5.

The occupational standards are designed and organized with clear performance criteria for each element of a unit of competency. These standards also outline the required knowledge and skills as well as evidence guide.

I am grateful to the Council Members, Council Secretariat, Mechanical Engineering SSAC, expert workers and all those who participated in the development of these Occupational Standards.

**Prof. CHARLES M. M. ONDIEKI, PhD, FIET (K), Con. EngTech.**

**CHAIRMAN, TVET CDACC**

# ACKNOWLEDGMENT

These Occupational Standards were developed through combined effort of various stakeholders from private and public organizations. I am thankful to the management of these organizations for allowing their staff to participate in this course. I wish to acknowledge the invaluable contribution of industry players who provided inputs towards the development of these Standards.

I thank TVET Curriculum Development, Assessment and Certification Council (TVET CDACC) for providing guidance on the development of these Standards. My gratitude goes to Mechanical Engineering Sector Skills Advisory Committee (SSAC) members for their contribution to the development of these Standards. I thank all the individuals and organizations who participated in the development of these Standards.

I acknowledge all other institutions which in one way or another contributed to the development of these Standards.

**CHAIRPERSON,**

**MECHANICAL ENGINEERING SECTOR SKILLS ADVISORY COMMITTEE**

# ACRONYMS

AC Air conditioning

BC Basic Competency

CC Common Competency

CR Core Competency

CDACC Curriculum Development, Assessment and Certification Council

CPU Control Powering Unit

DTI Dial test indicator

ENG Engineering

FOT Fixed orifice tube

GPS Global positioning system

ICT Information and Communication Technology

IT Information Technology

MPE Mechanical Plant Engineering

KPI King Pin inclination

OBD On-board diagnostics

OS Occupational Standards

PPE Personal protective equipment

SI Spark ignition

TVET Technical and Vocational Education and Training

TQM Total Quality Management

SOP Standard Operating Procedures

##

# **KEY TO UNIT CODE**

 **ENG/OS/MPE/BC /01/ 5/A**

Industry or sector

Occupational Standards

Occupational area

Type of competency

Competency number

Competency level

Version

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# OVERVIEW

The Mechanical Plant Technician Level 5 qualification consists of competencies that a person must achieve to enable him/her to workin a production plant. It entails installing mechanical plant machineries, performing plant maintenance, maintaining hydraulic and pneumatic systems, operating plant machines/utilities, performing workshop processes and managing spares and consumables inventory.

The units of competency comprising Plant Technician certificate level qualifications include the following basic, common and core competencies:

|  |
| --- |
| **BASIC UNITS OF COMPETENCY** |
| **Unit of competency Code**  | **Units of competency**  |
| ENG/OS/MPE/BC/01/5/A | Demonstrate communication skills |
| ENG/OS/MPE/BC/02/5/A | Demonstrate digital literacy |
| ENG/OS/MPE/BC/03/5/A | Demonstrate entrepreneurial skills |
| ENG/OS/MPE/BC/04/5/A | Demonstrate employability skills |
| ENG/OS/MPE/BC/05/5/A | Demonstrate environmental literacy |
| ENG/OS/MPE/BC/06/5/A | Demonstrate occupational health and safety |
| **COMMON UNITS OF COMPETENCY** |
| ENG/OS/MPE/CC/01/5/A | Prepare and interpret technical drawing |
| ENG/OS/MPE/CC/02/5/A | Apply engineering mathematics |
| ENG/OS/MPE/CC/03/5/A | Apply mechanical science principles |
| ENG/OS/MPE/CC/04/5/A | Apply thermodynamics principles |
| ENG/OS/MPE/CC/05/5/A | Apply fluid mechanics principles |
| **CORE UNITS OF COMPETENCY** |
| ENG/OS/MPE/CR/01/5/A | Install mechanical plant machineries |
| ENG/OS/MPE/CR/02/5/A | Perform plant maintenance |
| ENG/OS/MPE/CR/03/5/A | Maintain hydraulic and pneumatic systems |
| ENG/OS/MPE/CR/04/5/A | Operate plant machines/utilities |
| ENG/OS/MPE/CR/05/5/A | Perform workshop processes |
| ENG/OS/MPE/CR/06/5/A | Manage spares and consumables inventory |

##

# BASIC UNITS OF COMPETENCY

## DEMONSTRATE COMMUNICATION SKILLS

**UNIT CODE:** ENG/OS/MPE/BC/01/5/A

**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. Specific communication needs of clients and colleagues are identified and met.
	2. Different approaches are used to meet communication needs of clients and colleagues.
	3. Conflict is addressed promptly and in a timely way and in a manner, which does not compromise the standing of the organization.
 |
| 1. Develop communication strategies.
 | * 1. Strategies for effective internal and external dissemination of information are developed to meet the organization’s requirements.
	2. Special communication needs are considered in developing strategies to avoid discrimination in the workplace.
	3. Communication ***strategies*** are analyzed, evaluated and revised where necessary to make sure they are effective.
 |
| 1. Establish and maintain communication pathways.
 | * 1. Pathways of communication are established to meet requirements of organization and workforce.
	2. Pathways are maintained and reviewed to ensure personnel are informed of relevant information.
 |
| 1. Promote use of communication strategies.
 | * 1. Information is provided to all areas of the organization to facilitate implementation of the strategy.
	2. Effective communication techniques are articulated and modelled to the workforce.
	3. Personnel are given guidance about adapting communication strategies to suit a range of contexts.
 |
| 1. Conduct interview.
 | 1. A range of appropriate communication strategies are employed in ***interview situations.***
2. Records of interviews are made and maintained in accordance with organizational procedures.
3. Effective questioning, listening and nonverbal communication techniques are used to ensure that the required message is communicated.
 |
| 1. Facilitate group discussion.
 | * 1. Mechanisms which enhance ***effective group interaction*** is defined and implemented.
	2. Strategies which encourage all group members to participate are used routinely.
	3. Objectives and agenda for meetings and discussions are routinely set and followed.
	4. Relevant information is provided to the group to facilitate outcomes.
	5. Evaluation of group communication strategies is undertaken to promote participation of all parties.
	6. Specific communication needs of individuals are identified and addressed.
 |
| 1. 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. |

**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** |
| Communication strategies may include but not limited to: | * Language switch.
* Comprehension check.
* Repetition.
* Asking for confirmation.
* Paraphrase.
* Clarification request.
* Translation.
* Restructuring.
* Approximation.
* Generalization.
 |
| Effective group interaction may include but not limited to: | * Identifying and evaluating what is occurring within an interaction in a non-judgmental way.
* Using active listening.
* Making a decision about appropriate words, behavior.
* Putting together a response which is culturally appropriate.
* Expressing an individual perspective.
* Expressing own philosophy, ideology and background and exploring its impact with relevance to communication.
 |
| Situations may include but not limited to: | * Establishing rapport.
* Eliciting facts and information.
* Facilitating resolution of issues.
* Developing action plans.
* Diffusing potentially difficult situations.
 |

**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, knowledge, and range.

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

## DEMONSTRATE DIGITAL LITERACY

**UNIT CODE:** ENG/OS/MPE/BC/02/5/A

**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 keyoutcomes which make upWorkplace 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. Concepts of ICT are determined in accordance with computer equipment.
	2. Classifications of computers are determined in accordance with manufacturer’s specification.
	3. ***Appropriate computer software*** are identified according to manufacturer’s specification.
	4. ***Appropriate computer hardware*** are identified according to manufacturer’s specification.
	5. Functions and commands of operating system are determined in accordance with manufacturer’s specification.
 |
| 1. Apply security measures to data, hardware, and software in automated environment.
 | * 1. ***Data security and privacy are classified*** in accordance with the prevailing technology.
	2. ***Security threats*** are identified ***and control measures*** are applied in accordance with laws governing protection of ICT.
	3. Computer threats and crimes are detected.
	4. Protection against computer crimes is undertaken in accordance with laws governing protection of ICT.
 |
| 1. Apply computer software in solving tasks
 | * 1. ***Word processing concepts*** are applied in resolving workplace tasks, report writing and documentation.
	2. ***Word processing utilities*** are applied in accordance with workplace procedures.
	3. Worksheet layout is prepared in accordance with work procedures.
	4. Worksheets are built and data manipulated in the worksheets in accordance with workplace procedures.
	5. Continuous data manipulated on worksheet is undertaken in accordance with work requirements
	6. Database design and manipulation is undertaken in accordance with office procedures.
	7. Data sorting, indexing, storage, retrieval and security is provided in accordance with workplace procedures.
 |
| 1. Apply internet and email in communication at workplace.
 | * 1. Electronic mail addresses are opened and applied in workplace communication in accordance with office policy.
	2. Office internet functions are defined and executed in accordance with office procedures.
	3. ***Network configuration*** is determined in accordance with office operations procedures.
	4. Official World Wide Web is installed and managed according to workplace procedures.
 |
| 1. Apply Desktop publishing in official assignments.
 | * 1. Desktop publishing functions and tools are identified in accordance with manufactures specifications.
	2. Desktop publishing tools are developed in accordance with work requirements.
	3. Desktop publishing tools are applied in accordance with workplace requirements.
	4. Typeset work is enhanced in accordance with workplace standards.
 |
| 1. Prepare presentation packages.
 | * 1. Types of presentation packages are identified in accordance with office requirements.
	2. Slides are created and formulated in accordance with workplace procedures.
	3. Slides are edited and run in accordance with work procedures.
	4. Slides and handouts are printed according to work requirements.
 |

**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** |
| --- | --- |
| Appropriate computer software may 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.  |
| Appropriate computer hardware may include but not limited to: | Collection of physical parts of a computer system such as;* Computer case, monitor, keyboard, and mouse
* All the parts inside the computer case, such as the hard disk drive, motherboard and video card.
 |
| Data security and privacy may include but not limited to: | * Confidentiality of data.
* Cloud computing.
* Integrity-but-curious data surfing.
 |
| Security and control measures may include but not limited to:  | * Counter measures against cyber terrorism.
* Risk reduction.
* Cyber threat issues.
* Risk management.
* Pass-wording.
 |
| Security threats may include but not limited to: | * Cyber terrorism.
* Hacking.
 |
| Word processing concepts may include but not limited to: | Using a special program to create, edit and print documents. |
| Network configuration may include but not limited to:  | Organizing and maintaining information on the components of a computer network. |

**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 handouts.
* 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.

###### **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. Identified and controlled security threats.
	2. Detected and protected computer crimes.
	3. Applied word processing in office tasks.
	4. Designed, prepared work sheet and applied data to the cells in accordance to workplace procedures.
	5. Opened electronic mail for office communication as per workplace procedure.
	6. Installed internet and World Wide Web for office tasks in accordance with office procedures.
	7. Integrated emerging issues in computer ICT applications.
	8. Applied laws governing protection of ICT.
 |
| 1. Resource Implications.
 | * 1. Tablets.
	2. Laptops.
	3. Desktop PCs.
	4. Desktop computer.
	5. Calculator.
	6. Internet.
	7. Smart phone.
	8. Operations Manuals.
 |
| 1. Methods of Assessment.
 | Competency may be assessed through:* 1. Written Test.
	2. Demonstration.
	3. Practical assignment.
	4. Interview/Oral Questioning.
	5. Demonstration.
 |
| 1. Context of Assessment.
 | Competency may be assessed in an off and on the job setting. |
| 1. Guidance information for assessment.
 | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## DEMONSTRATE ENTREPRENEURIAL SKILLS

**UNIT CODE:** ENG/OS/MPE/BC/03/5/A

**Unit description**

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**These describe the keyoutcomes 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. Develop business Innovative strategies.
 | 1. Business innovation strategies are determined in accordance with the organization strategies.
2. Business innovation strategies are implemented for the purpose of business growth.
3. Track record and normative capability profile of enterprise and similar businesses are reviewed and considered in setting ***strategic directions***.
4. Strengths, weaknesses, opportunities and threats are considered when developing new ideas, approaches, goals and directions.
5. Decisions about enterprise strategies/directions are made after careful consideration of all relevant information.
6. ***Business/corporate plan*** is developed that sets out tactics, resource implications, timeframes, production and sales target.
 |
| 1. Develop new products/ markets.
 | * 1. Alternative product/service offerings are canvassed and studied for feasibility.
	2. Potential and new sources/sellers of supplies and raw materials are identified and canvassed.
	3. Target markets and buyers are identified and surveyed as to their preferences and brand loyalties.
 |
| 1. 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.  |
| 1. Motivate staff/workers.
 | 4.1 Regular dialogue is established and maintained in all 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. |
| 1. 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. |
| 1. 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. |

**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**  |
| Strategic directions may include but not limited to: | * + Business continuity and succession
	+ Resource access security.
	+ Core competencies development.
* New developments e.g. technological change, new products.
 |
| Business/Corporate plan may include but not limited to: | * Action steps and responsibilities of departments and individual workers.
* Resource requirements and budget.
* Tactics and strategies to achieve objectives.
 |
| Helpful mechanisms may include but not limited to: | * Wage and non-wage benefits.
	+ Employee awards and recognition systems.
	+ Employee rights and welfare policies.
* 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”.

**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 candidate:1.1 Demonstrated ability to maintain a profitable and stable enterprise as shown by stakeholder feedback, employee testimonies and company financial statements1.2 Demonstrated ability to conceptualize and plan a micro/small enterprise1.3 Demonstrated ability to manage/operate a micro/small-scale business1.4 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. |

## DEMONSTRATE EMPLOYABILITY SKILLS

**UNIT CODE:** ENG/OS/MPE/BC/04/5/A

**Unit description**

This unit covers competencies required to demonstrate employability skills. It involves conducting self-management, demonstrating interpersonal communication, critical safe work habits, leading small teams, planning and organizing work, maintaining professional growth and development, demonstrating workplace learning, problem solving skills and workplace ethics.

**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. Conduct self-management
 | 1. Personal vision, mission and goals are formulated based on potential and in relation to organization objectives
2. Emotions are managed as per workplace requirements
3. Individual performance is evaluated and monitored according to the agreed targets.
4. Assertiveness is developed and maintained based on the requirements of the job.
5. Accountability and responsibility for own actions are demonstrated.
6. Self-esteem and a positive self-image are developed and maintained.
7. Time management, attendance and punctuality are observed as per the organization policy.
8. Goals are managed as per the organization’s objective
9. Self-strengths and weaknesses are identified as per ***personal objectives***
10. Critics are managed as per personal objectives
 |
| 1. Demonstrate interpersonal communication
 | 1. Listening and understanding is demonstrated as per communication policy
2. Writing to the needs of the audience is demonstrated as per communication policy
3. Speaking, reading and writing is demonstrated as per communication policy
4. Empathising is demonstrated as per the communication policy
5. Internal and external customers’ needs are identified and interpreted as per the communication policy
6. Persuasion is demonstrated as per the communication policy
7. Communication nnetworks are established as per the SOPs
8. Information is shared as per communication structure
 |
| 1. Demonstrate critical safe work habits
 | * 1. Stress is managed in accordance with workplace procedures.
	2. Punctuality and time consciousness is demonstrated in line with workplace policy.
	3. Personal objectives are integrated with organization goals based on organization’s strategic plan.
	4. Work priorities are set in accordance to workplace procedures.
	5. Leisure time is recognized in line with organization policy.
	6. Abstinence from ***drug and substance abuse*** is observed as per workplace policy.
	7. Awareness of HIV and AIDS is demonstrated in line with workplace requirements.
	8. Safety consciousness is demonstrated in the workplace based on organization safety policy.
	9. ***Emerging issues*** are dealt with in accordance with organization policy.
 |
| 1. Lead small teams
 | 1. Performance expectations for the ***team*** are set as per the organization objectives
2. Tasks are assigned in accordance with the organization policy.
3. Team performance indicators are identified according to set rules and regulations.
4. ***Forms of communication*** in a team are established according to office policy.
5. Communication is carried out as per workplace place policy and requirements of the job.
6. ***Feedback*** on performance is collected and analyzed based on established team learning process
7. ***Gender mainstreaming*** is undertaken in accordance with set regulations.
 |
| 1. Plan and organize work
 | 1. Task requirements are identified as per the workplace objectives
2. Task is interpreted in accordance with safety (OHS ), environmental requirements and quality requirements
3. Work activity is organized with other involved personnel as per the SOPs
4. Resources are mobilized, allocated and utilized to meet project goals and deliverables.
5. Work activities are monitored and evaluated in line with organization procedures.
6. Job planning is documented in accordance with workplace requirements.
7. Time is managed achieve workplace set goals and objectives.
 |
| 1. Maintain professional growth and development
 | * 1. Personal training needs are identified and assessed in line with the requirements of the job.
	2. ***Training and career opportunities*** are identified and availed based on job requirements.
	3. Licensees and certifications relevant to job and career are obtained and renewed.
	4. ***Personal growth*** is pursued towards improving the qualifications set for the profession.
	5. Work priorities are identified based on requirement of the job and workplace policy.
	6. Recognitions are sought as proof of career advancement in line with professional requirements.
 |
| 1. Demonstrate workplace learning
 | * 1. Own learning is managed as per workplace policy.
	2. Learning opportunities are sought and allocated based on job requirement and in line with organization policy.
	3. Contribution to the learning community at the workplace is carried out.
	4. ***Range of media for learning*** are identified as per the training need
	5. Application of learning is demonstrated in both technical and non-technical aspects based on requirements of the job
	6. Enthusiasm for ongoing learning is demonstrated
	7. Time and effort is invested in learning new skills-based job requirements
	8. Willingness to learn in different context is demonstrated based on available learning opportunities arising in the workplace.
	9. Opportunities for performance improvement are identified proactively in area of work.
	10. Awareness of personal role in workplace ***innovation*** is demonstrated.
 |
| 1. Demonstrate problem solving skills
 | * 1. Problems are identified as per the context of data and circumstances
	2. Problem solutions are sought based on the problem
	3. Independence and initiative in identifying and solving problems is demonstrated.
	4. Team problems are solved as per the workplace guidelines
	5. Problem solving strategies are applied as per the workplace guidelines
 |
| 1. Demonstrate workplace ethics
 | * 1. Policies and guidelines are observed as per the workplace requirements
	2. Self-worth and profession is exercised in line with personal goals and organizational policies
	3. Code of conduct is observed as per the workplace requirements
	4. Personal and professional integrity is demonstrated as per the personal goals
	5. Commitment to jurisdictional laws is demonstrated as per the workplace requirements
 |

**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** |
| Drug and substance abuse includes but not limited to: | Commonly abused* Alcohol
* Tobacco
* Miraa
* Over-the-counter drugs
* Cocaine
* Bhang
* Glue
 |
| Feedback includes but not limited to: | * Verbal
* Written
* Informal
* Formal
 |
| Relationships includes but not limited to: | * Man/Woman
* Trainer/trainee
* Employee/employer
* Client/service provider
* Husband/wife
* Boy/girl
* Parent/child
* Sibling relationships
 |
| Forms of communicationinclude but not limited to: | * Written
* Visual
* Verbal
* Non verbal
* Formal and informal
 |
| Team includes but not limited to: | * Small work group
* Staff in a section/department
* Inter-agency group
 |
| Personal growth includes but not limited to: |

|  |
| --- |
| * Growth in the job
* Career mobility
* Gains and exposure the job gives
* Net workings
* Benefits that accrue to the individual as a result of noteworthy performance
 |

 |
| Personal objectives include but not limited to: | * Long term
* Short term
* Broad
* Specific
 |
| Trainings and career opportunities includes but not limited to | * Participation in training programs
* Technical
* Supervisory
* Managerial
* Continuing Education
* Serving as Resource Persons in conferences and workshops
 |
| Resource include but not limited to: | * Human
* Financial
* Technology
* Hardware
* Software
 |
| Innovation include but not limited to: | * New ideas
* Original ideas
* Different ideas
* Methods/procedures
* Processes
* New tools
 |
| Emerging issues include but not limited to: | * Terrorism
* Social media
* National cohesion
* Open offices
 |
| Range of media for learninginclude but not limited to:  | * Mentoring
* peer support and networking
* IT and courses
 |

**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
	+ 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 candidate:* 1. Conducted self-management
	2. Demonstrated interpersonal communication
	3. Demonstrated critical safe work habits
	4. Led small teams
	5. Planned and organized work
	6. Maintained professional growth and development
	7. Demonstrated workplace learning
	8. Demonstrated problem solving skills
	9. Demonstrated workplace ethics
 |
| 1. Resource Implications
 |

|  |
| --- |
| The following resources should be provided:  |

* 1. Case studies/scenarios
 |
| 1. Methods of Assessment
 | Competency in this unit may be assessed through: * Oral Interview
* Observation
* Third Party Reports
* Written
 |
| 1. Context of Assessment
 | * 1. Competency may be assessed in workplace or in a simulated workplace setting
	2. Assessment shall be observed while tasks are being undertaken whether individually or in-group
 |
| 1. Guidance information for assessment
 | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## DEMONSTRATE ENVIRONMENTAL LITERACY

**UNIT CODE:** ENG/OS/MPE/BC/05/5/A

**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, analyze resource use, develop resource conservation plans and implement selected plans.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**These describe the keyoutcomes which make upWorkplace 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. ***Storage methods*** for environmentally hazardous materials are strictly followed according to environmental regulations and OSHS.
	2. ***Disposal methods*** of hazardous wastes are followed at all times according to environmental regulations and OSHS.
	3. ***PPE*** is used according to OSHS.
 |
| 1. Control environmental Pollution control.
 | * 1. Environmental pollution ***control measures*** are compiled following standard protocol.
	2. Procedures for solid waste management are observed according Environmental Management and Coordination Act 1999.
	3. Methods for minimizing ***noise pollution*** complied following environmental regulations.
 |
| 1. Demonstrate sustainable resource use.
 | * 1. Methods for minimizing wastage are complied with.
	2. Waste management procedures are employed following principles of 3Rs (Reduce, Reuse, and Recycle).
	3. Methods for economizing or reducing resource consumption are practiced.
 |
| 1. Evaluate current practices in relation to resource usage.
 | * 1. Information on resource efficiency systems and procedures are collected and provided to the work group where appropriate.
	2. Current resource usage is measured and recorded by members of the work group.
	3. Current purchasing strategies are analyzed and recorded according to industry procedures.
	4. Current work processes to access information and data is analyzed following enterprise protocol.
 |
| 1. Identify Environmental legislations/conventions for environmental concerns.
 | 5.1 Environmental legislations/conventions and local ordinances are identified according to the different environmental aspects/impact5.2 Industrial standard/environmental practices are described according to the different environmental concerns |
| 1. 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 guidelines6.4 Stakeholders are consulted based on company guidelines |
| 1. 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 analysed based on Evaluation requirements.7.4 Recommendations are submitted based on the findings7.5 Management support systems are set/established to sustain and enhance the program.7.6 Environmental incidents are monitored and reported to concerned/ proper authorities. |
| 1. Analyze resource use.
 | * 1. All resource consuming processes are identified.
	2. Quantity and nature of Resource consumed is determined
	3. Resource flow is analysed through different parts of the process.
	4. Waste is classified for possible source of resources.
 |
| 1. Develop resource Conservation plans.
 | * 1. Efficiency of use/conversion of resources is determined following industry protocol.
	2. Causes of low efficiency of use of resources are determined based on industry protocol.
	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** |
| PPE may include but not limited to: | 1.1 Mask.1.2 Gloves.1.3 Goggles.1.4 Safety hat.1.5 Overall.1.6 Hearing protector. |
| Environmental pollutionControl measures may include but 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. |
| Wastes may include but not limited to: | 3.1 Unnecessary waste.3.2 Necessary waste. |
| Waste management Procedures may include but not limited to: | 4.1 Sorting.4.2 Storing of items.4.2 Recycling of items.4.3 Disposal of items. |
| Resources may include but not limited to: | 5.1 Electric.5.2 Water.5.3 Fuel.5.4 Telecommunications.5.5 Supplies.5.6 Materials. |
| Workplace environmentalHazards may include but not limited to: | 6.1Biological hazards.6.2 Chemical and dust hazards.6.3 Physical hazards. |
| Organizational systems andProcedures may include but not limited to: | 7.1 Supply chain, procurement and purchasing.7.2 Quality assurance.7.3 Making recommendations and seeking approvals. |
| Legislations/Conventions may include but not limited to: | 8.1 EMCA 1999.8.2 Montreal Protocol.8.3 Kyoto Protocol. |
| Environmentalaspects/impacts may include but 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. |
| Industrial standards /Environmental practices may include but not limited to: | 10.1 ISO standards.10.2 Company environmental management systems (EMS)  |
| Periodic may include but not limited to: | 11.1 Hourly.11.2 Daily11.3 Weekly11.4 Monthly11.5 Quarterly11.6 Yearly |
| Programs/Activities may include but 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. |

**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.
* 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.
* 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.

**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. Controlled environmental hazard.
	2. Controlled environmental pollution.
	3. Demonstrated sustainable resource use.
	4. Evaluated current practices in relation to resource usage.
	5. Demonstrated knowledge of environmental legislations and local ordinances according to the different environmental issues /concerns.
	6. Described industrial standard environmental practices according to the different environmental issues/concerns.
	7. Resolved problems/ constraints encountered based on management standard procedures.
	8. Implemented and monitored environmental practices on a periodic basis as per company guidelines.
	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:* 1. Workplace with storage facilities
	2. Tools, materials and equipment relevant to the tasks (e.g. Cleaning tools, cleaning materials, trash bags)
	3. PPE, manuals and references
	4. Legislation, policies, procedures, protocols and local ordinances relating to environmental protection
	5. Case studies/scenarios relating to environmental Protection
 |
| 1. Methods of Assessment.
 | Competency in this unit may be assessed through:* 1. Demonstration.
	2. Oral questioning.
	3. Written examination.
	4. Interview/Third Party Reports.
	5. Portfolio (citations/awards from GOs and NGOs, certificate of training – local and abroad).
	6. Simulations and role-play.
 |
| 1. 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.  |
| 1. Guidance information for assessment
 | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## DEMONSTRATE OCCUPATIONAL SAFETY AND HEALTH PRACTICES

**UNIT CODE:** ENG/OS/MPE/BC/06/5/A

**Unit description**

This unit specifies the competencies required to lead the implementation of work place 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*** |
| --- | --- |
| 1. Work in a safe and clean environment. | 1.2 Work area is cleaned and made safe before use in accordance with organization policy, Factories Act 1977, OSH Act 20071.3 Tools and equipment are used as per the manufactures manual* 1. Health and safety regulations are observed as per OSH Act 2007

1.5 Waste oil, fluids and scrap components are disposed of in accordance with EMC Act 2012 |
| 1. Identify workplace hazards
 | * 1. ***Hazards*** in the workplace and/or its ***indicators*** of its presence, are identified.
	2. ***Evaluation and/or work environment*** measurements of OSH hazards/risk existing in the workplace is conducted by authorized personnel or agency.
	3. ***OSH issues and/or concerns*** raised by workers are gathered.
 |
| 1. Identify and implement appropriate control measures
 | * 1. ***Prevention and control measures***, including use of

 s***afety gears / PPE (personal protective equipment)*** for specific hazards identified and implemented.* 1. ***Appropriate risk controls*** based on result of OSH hazard evaluation is recommended.
	2. ***Contingency measures***, including ***emergency procedures*** during workplace ***incidents and emergencies*** are recognized and established in accordance with organization procedures.
 |
| 1. Implement OSH programs, procedures and policies/ guidelines
 | * 1. Information to work team about company OSH program, procedures and policies/guidelines are provided.
	2. Implementation of OSH procedures and policies/ guidelines are participated.
	3. Team members are trained and advised on OSH standards and procedures.
	4. Procedures for maintaining ***OSH-related records*** are implemented.
 |

**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 not limited to:
 | * Physical hazards – impact, illumination, pressure, noise,

 Vibration, extreme temperature, radiation.* Biological hazards- bacteria, viruses, plants, parasites, mites, molds, fungi, and insects.
* Chemical hazards – dusts, fibers, mists, fumes, smoke, gasses, vapors.
* Ergonomics;

 Psychological factors – over exertion/ excessive force, awkward/static positions, fatigue, direct pressure, varying metabolic cycles; Physiological factors – monotony, personal relationship work out cycle;* Safety hazards (unsafe workplace condition) –

 confined space, excavations, falling objects, gas leaks, electrical, poor storage of materials and waste, spillage, waste and debris;* Unsafe workers’ act (Smoking in off-limited areas, Substance and alcohol abuse at work);
 |
| 1. Indicators may include but not limited to:
 | * Increased of incidents of accidents, injuries;
* Increased occurrence of sickness or health complaints/ symptoms;
* Common complaints of workers related to OSH;
* High absenteeism for work-related reasons;
 |
| 1. Evaluation and/or work environment measurements may include but not limited to:
 | * Health Audit;
* Safety Audit;
* Work Safety and Health Evaluation;
* Work Environment Measurements of Physical and Chemical Hazards.
 |
| 1. OSH issues and/or concerns may include but not limited to:
 | * Workers’ experience/observance on presence of work hazards.
* Unsafe/unhealthy administrative arrangements (prolonged work hours, no break time, constant overtime, scheduling of tasks).
* Reasons for compliance/non-compliance to use of PPEs or other OSH procedures/policies/guidelines.
 |
| 1. Prevention and control measures may include but not limited to:
 | * Eliminate the hazard (i.e., get rid of the dangerous machine
* Isolate the hazard (i.e. keep the machine in a closed room and operate it remotely; barricade an unsafe area off)
* Substitute the hazard with a safer alternative (i.e., replace the machine with a safer one).
* 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).
* Use engineering controls to reduce the risk (i.e. use safety guards to machine).
* Use personal protective equipment.
* Safety, Health and Work Environment Evaluation.
* Periodic and/or special medical examinations of workers.
 |
| 1. Safety gears /PPE (Personal Protective Equipment) may include but not limited to:
 | * Arm/Hand guard, gloves.
* Eye protection (goggles, shield).
* Hearing protection (ear muffs, ear plugs).
* Hair Net/cap/bonnet.
* Hard hat.
* Face protection (mask, shield).
* Apron/Gown/coverall/jump suit.
* Anti-static suits.
* High-visibility reflective vest.
 |
| 1. Appropriate risk controls may include but not limited to:
 | * Appropriate risk controls in order of impact are as follows:
* Eliminate the hazard altogether (i.e., get rid of the dangerous machine).
* 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).
* Substitute the hazard with a safer alternative (i.e. replace the machine with a safer one).
* 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).
* Use engineering controls to reduce the risk (i.e., attach guards to the machine to protect users).
* Use personal protective equipment (i.e. wear

gloves and goggles when using the machine) |
| 1. Contingency measures may include but not limited to:
 | * Evacuation.
* Isolation.
* Decontamination.
* (Calling designed) emergency personnel.
 |
| 1. Emergency procedures may include but not limited to:
 | * Fire drill.
* Earthquake drill.
* Basic life support/CPR.
* First aid.
* Spillage control.
* Decontamination of chemical and toxic
* Disaster preparedness/management
* Set of fire-extinguisher.
 |
| 1. Incidents and emergencies may include but not limited to:
 | * Chemical spills.
* Equipment/vehicle accidents.
* Explosion
* Fire
* Gas leak.
* Injury to personnel.
* Structural collapse.
* Toxic and/or flammable vapors emission.
 |
| 1. OSH-related Records may include but not limited to:
 | * Medical/Health records.
* Incident/accident reports.
* Sickness notifications/sick leave application.
* OSH-related trainings obtained
 |

**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 candidate:1. Identifies hazards/risks in the workplace and/or its indicators.
2. Requests for evaluation and/or work environment measurements of OSH hazards/risk in the workplace.
3. Gathers OSH issues and/or concerns raised by workers.
4. Identifies and implements prevention and control measures, including use of PPE (personal protective equipment) for specific hazards.
5. Recommends appropriate risk controls based on result of OSH hazard evaluation and OSH issues gathered.
6. Establish contingency measures, including emergency procedures in accordance with organization procedures.
7. Provides information to work team about company OSH program, procedures and policies/guidelines.
8. Participates in the implementation of OSH procedures and policies/guidelines.
9. Trains and advises team members on OSH standards and procedures.

1.10 Implements procedures for maintaining OSH-related records. |
| 1. 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. |
| 1. 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. |
| 1. 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.  |
| 1. Guidance information for assessment.
 | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# COMMON UNITS OF COMPETENCY

## PREPARE AND INTERPRET TECHNICAL DRAWINGS

**UNIT CODE:** ENG/OS/MPE/CC/01/5/A

**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 of components and application of 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. ***Drawing equipment*** are identified and gathered according to task requirements
	2. ***Drawing materials*** are identified and gathered according to task requirements
	3. Drawing equipment are used and maintained as per manufacturer’s instructions
	4. Drawing materials are used as per workplace procedures
	5. Waste materials are disposed in accordance with workplace procedures and ***environmental legislations***
	6. ***Personal Protective Equipment*** is used according to occupational safety and health regulations
 |
| 1. Produce plain geometry drawings
 | * 1. Different types of lines used in drawing and their meanings are identified according to standard drawing conventions
	2. Different types of ***geometric forms*** are constructed according to standard drawing conventions
	3. Different types of angles are constructed according to principles of trigonometry
	4. Different types of angles are measured using appropriate measuring tools
	5. Angles are bisected according to standard drawing conventions
	6. Sketches and drawings of patterns are interpreted according to standard conventions
	7. Patterns are developed in accordance with standard conventions
 |
| 1. Produce pictorial and orthographic drawings of components
 | * 1. Different symbols and abbreviations are identified and their meaning interpreted according to standard drawing conventions
	2. Isometric sketches and drawings of components are interpreted and produced in accordance with the standard conventions of isometric drawings
	3. First and third angle orthographic sketches and drawings of components are interpreted and produced in accordance with the standard conventions of orthographic drawings
	4. Freehand sketching of different types of geometric forms, tools, equipment, diagrams and components is conducted
 |
| 1. Produce assembly drawings
 | * 1. Orthographic views are exploded according to standard conventions of orthographic drawings.
	2. Pictorial views are exploded according to standard conventions of orthographic drawings.
	3. Part lists are identified according to part to be produced
	4. Sectional views are produced according to standard conventions of drawing.
	5. Produced drawing is hatched according to standard conventions of drawings.
 |
| 1. Apply CAD packages in drawing
 | * 1. CAD packages are selected according to task requirements
	2. CAD packages are applied in production of plant machine parts.
 |

**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** |
| --- | --- |
| Drawing equipment may include but not limited to: | * Drawing boards
* T-square
* Set squares
* Drawing set
* Computers with CAD packages
 |
| Drawing materials may include but not limited to: | * Drawing papers
* Pencils
* Erasers
* Masking tapes
* Paper clips
 |
| Environmental legislations may include but not limited to: | EMCA 1999 |
| Personal Protective Equipment may include but not limited to: | * Dust coats
* Closed leather shoes
* Goggles for CAD
 |
| Geometric forms may include but not limited to: | * Circles
* Triangles
* Rectangles
* Parallelogram
* Polygons
* Pyramids
* Conic sections
* Prisms
* Loci
 |
| Standard drawing conventions may include but 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
 |

**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

**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. Applied and adhered to safety procedures
	2. Cared and maintained drawing equipment
	3. Interpreted technical diagrams
	4. Applied appropriate technical standards, used proper tools and equipment for a given task
	5. Produced sketches and drawings
	6. Applied CAD packages in production of drawings
 |
| 1. Resource Implications
 | Resources the same as that of workplace are advised to be applied.* 1. Drawing room
	2. Drawing equipment and materials
	3. Computers
	4. CAD packages
	5. PPE
 |
| 1. Methods of Assessment
 | Competency may be assessed through:* 1. Practical tests
	2. Observation
	3. Written tests
 |
| 1. Context of Assessment
 | Competency may be assessed individually in the actual workplace or a simulated work place setting |
| 1. Guidance information for assessment
 | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY ENGINEERING MATHEMATICS

**UNIT CODE:** ENG/OS/MPE/CC/02/5/A

**Unit description:**

This unit describes the competencies required by a technician in order to apply engineering mathematics. It involves competencies required to apply algebra, trigonometry and hyperbolic functions, complex numbers, coordinate geometry, carry out binomial expansion, calculus, solve ordinary differential equations, carry out mensuration, apply power series, statistics, numerical methods, vector theory and 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. Calculations involving Indices are performed as per the concept
	2. Calculations involving Logarithms are performed as per the concept
	3. Scientific calculator is used in solving mathematical problems in line with manufacturer’s manual
	4. Simultaneous equations are performed as per the rules
	5. Quadratic equations are calculated as per the concept
	6. Permutations and combinations are performed
 |
| * 1. Apply Trigonometry and hyperbolic functions
 | * 1. Calculations are performed using trigonometric rules
	2. Calculations are performed using hyperbolic functions
 |
| * 1. Apply complex numbers
 | 3.1 Complex numbers are represented using Argand diagrams3.2 Operations involving complex numbers are performed3.3 Calculations involving complex numbers are performed using De Moivre’s theorem |
| * 1. Apply Coordinate Geometry
 | * 1. Polar equations are calculated using coordinate geometry
	2. Graphs of given polar equations are drawn using the Cartesian plane
	3. Normal and tangents are determined using coordinate geometry
 |
| * 1. Carry out Binomial Expansion
 | * 1. Roots of numbers are determined using binomial theorem
	2. Errors of small changes are determined using binomial theorem
 |
| * 1. Apply Calculus
 | * 1. Derivatives of functions are determined using Differentiation
	2. Derivatives of hyperbolic functions are determined using Differentiation
	3. Derivatives of inverse trigonometric functions are determined using Differentiation
	4. Rate of change and small change are determined using Differentiation.
	5. Calculation involving stationery points of functions of two variables are performed using differentiation.
	6. Integrals of algebraic functions are determined using integration
	7. Integrals of trigonometric functions are determined using integration
	8. Integrals of logarithmic functions are determined using integration
	9. Integrals of hyperbolic and inverse functions are determined using integration
 |
| * 1. Solve Ordinary differential equations
 | * 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 |
| * 1. Carry out Mensuration
 | * 1. Perimeter and areas of figures are obtained
	2. Volume and Surface area of solids are obtained
	3. Area of irregular figures are obtained
	4. Areas and volumes are obtained using Pappus theorem
 |
| * 1. Apply Power Series
 | * 1. Power series are obtained using Taylor’s Theorem
	2. Power series are obtained using McLaurin’s ‘s theorem
 |
| * 1. Apply Statistics
 | * 1. Mean, median, mode and Standard deviation are obtained from given data
	2. Calculations are performed based on Laws of probability
	3. Calculation involving ***probability distributions*,** mathematical expectation sampling distributions are performed
	4. Sampling distribution methods are applied in data analysis
	5. Calculations involving use of standard normal table, sampling distribution, T-distribution and Estimation are done
	6. Confidence intervals are determined
 |
| * 1. Apply Numerical methods
 | * 1. Roots of polynomials are obtained using iterative ***numerical methods***
	2. Interpolation and extrapolation is performed using numerical methods
 |
| * 1. Apply Vector theory
 | * 1. Vectors and scalar quantities are obtained in two and three dimensions
	2. ***Operations*** on vectors are performed
	3. Position of vectors is obtained
	4. Resolution of vectors is done
 |
| * 1. Apply Matrix
 | * 1. Determinant and inverse of 3x3 matrix are obtained
	2. Solutions of simultaneous equations are obtained
	3. Calculation involving Eigen values and Eigen vectors are performed
 |

**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** |
| Operations may include but not limited to: | * + Addition
	+ Subtraction
 |
| Hyperbolic functions may include but not limited to: | * + Sinh x
	+ Cosh x
	+ Cosec x
	+ Coth x
	+ Tanh x
	+ Sech x
 |
| Probability Distributions may include but not limited to: | * + Binomial
	+ Poisson
	+ Normal
 |
| Numerical Methods may include but not limited to: | * + Newton Raphson
	+ 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:

* 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.

|  |  |
| --- | --- |
| * 1. Critical aspects of Competency
 | Assessment requires evidence that the candidate: 1. Applied Trigonometry and hyperbolic functions
2. Applied complex numbers
3. Applied Calculus
4. Solved Ordinary differential equations
5. Carried out mensuration
6. Applied Power Series
7. Applied vectors
8. Applied numerical methods
9. Applied statistics
 |
| * 1. Resource Implications
 | The following resources should be provided: * 1. Access to relevant workplace or appropriately simulated environment where assessment can take place
	2. Measuring equipment
	3. Materials relevant to the proposed activity or tasks
 |
| * 1. Methods of Assessment
 | Competency in this unit may be assessed through: * 1. Direct Observation
	2. Demonstration with Oral Questioning
	3. Written tests
 |
| * 1. Context of Assessment
 | Competency may be assessed individually in the actual workplace orthrough accredited institution  |
| * 1. Guidance information for assessment
 | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY MECHANICAL SCIENCE PRINCIPLES

**UNIT CODE:** ENG/OS/MPE/CC/03/5/A

**Unit description**

This unit describes the competencies required by a technician to apply mechanical science principles in their work. It includes determining forces in a system, demonstrating knowledge of moments, understanding friction principles, understanding motions in engineering, describing work, energy and power, performing machine calculations, demonstrating gas principles, applying heat knowledge, applying density knowledge and applying pressure principles.

**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. Determine forces in a system
 | * 1. Forces are defined and described
	2. ***Forces theorems*** are described
	3. Resultant of coplanar forces are determined.
 |
| 1. Demonstrate knowledge of moments
 | * 1. Moments are defined
	2. Moments are calculated
	3. Principles of moments are described
	4. Couples are identified and applied in engineering systems.
 |
| 1. Understand friction principles
 | * 1. Laws of friction are identified
	2. Limiting friction is calculated
	3. Forces applied at an angle to a horizontal plane are calculated
	4. Coefficient of friction is calculated
	5. Advantages and disadvantages of friction are identified.
 |
| 1. Understand motions in engineering
 | * 1. Motion concepts are discussed
	2. Laws of motion are identified
	3. Motion calculations are performed
	4. Displacement/time graphs are applied
 |
| 1. Describe work, energy and power
 | * 1. Work is calculated
	2. Energy is calculated
	3. Power calculations are performed
 |
| 1. Perform machine calculations
 | * 1. ***Problems on simple machines*** are solved
	2. Problems on levers are solved
	3. Laws of machines are identified
 |
| 1. Demonstrate gas principles
 | * 1. ***Gas laws*** are identified
	2. Gas laws are applied in solving engineering problems
	3. Uses of gases in engineering systems are identified
 |
| 1. Apply heat knowledge
 | * 1. Heat concepts are discussed
	2. Working principle of heat is defined
	3. Heat capacity is discussed
	4. Heat problems are solved
 |
| 1. Apply density knowledge
 | * 1. ***Density terminology*** are discussed
	2. Density measurements are carried out
	3. Density problems are solved
 |
| 1. Apply pressure principles
 | * 1. Pressure concepts are discussed
	2. Working principles of pressure is discussed
	3. Pressure problems are solved
	4. ***Pressure applications*** are identified
 |

**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** |
| Forces theorems may include but not limited to: | * + Parallelogram
	+ Triangle
	+ Polygon
 |
| Problems on simple machines may include but not limited to: | * + Machine advantage
	+ Velocity ratio
	+ Efficiency
 |
| Gas laws may include but not limited to: | * + Boyles law
	+ Charles law
	+ Gas equation
 |
| Density terminology may include but not limited to: | * + Density
	+ Relative density
 |
| Pressure applications may include but not limited to: | * + Vacuum pump
	+ Hydraulic pump
	+ Hydrometers
 |
| Principles may include but not limited to: | * + Newton’s laws of motion
	+ Law of conservation of linear momentum
	+ Law of conservation of energy
	+ Archimedes’ principle
 |
| Mechanical calculations may include but not limited to: | * + Mechanical advantage
	+ Efficiency
	+ Torque
	+ Power/Energy
	+ Work done
 |
| Laws of fluids may include but not limited to: | * + Pascal’s principle
	+ Gas laws
 |

**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

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Newton’s law
* Levers
* Gear trains
* 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
* SI units of mechanical energy.
* Power transmission systems
* Parameters of fluid system
* Operation of mechanical machines
* Mechanical calculation of power, energy, work done, torque and safety factor
* Units of measurement, conversions 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.

|  |  |
| --- | --- |
| 1. Critical aspects of Competency
 | Assessment requires evidence that the candidate: * 1. Determined forces in a system
	2. Demonstrated knowledge of moments
	3. Understood friction principles
	4. Understood motions in engineering
	5. Described work, energy and power
	6. Performed machine calculations
	7. Demonstrated gas principles
	8. Applied heat knowledge
	9. Applied density knowledge
	10. Applied pressure principles
 |
| 1. Resource Implications
 | The following resources should be provided: * 1. Access to relevant workplace or appropriately simulated environment where assessment can take place
	2. Measuring tools and equipment
	3. Sample materials to be tested
 |
| 1. Methods of Assessment
 | Competency in this unit may be assessed through: * 1. Direct Observation
	2. Demonstration with Oral Questioning
	3. Case studies
	4. Written tests
 |
| 1. Context of Assessment
 | Competency may be assessed individually in the actual workplace orthrough accredited institution  |
| 1. Guidance information for assessment
 | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY THERMODYNAMICS PRINCIPLES

**UNIT CODE:** ENG/OS/MPE/CC/04/5/A

**Unit description**

This unit describes the competencies required by a technician in order to apply thermodynamics principles in their work. It includes understanding fundamentals of thermodynamics, performing steady flow processes, performing non-steady flow processes, understanding perfect gases, generating steam, performing thermodynamics reversibility and entropy, understanding idea gas cycle, demonstrating fuel and combustion, perform heat transfer, understanding heat exchangers, understanding air compressors, understanding gas turbines and understanding of impulse steam turbines

**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. Understand fundamentals of thermodynamics
 | * 1. Terms used in thermodynamics are described according to prescribed guidelines
	2. Thermodynamics processes and cycles are described according to prescribed guidelines
	3. First law of thermodynamics is applied in accordance to prescribed guidelines
 |
| 1. Perform steady flow processes
 | * 1. Steady flow energy equation is derived according to prescribed thermodynamics guidelines
	2. Steady flow energy equation is applied in problem solving according to prescribed thermodynamics guidelines
	3. Steady flow energy equation is applied in ***utilities*** according to prescribed thermodynamics guidelines
 |
| 1. Perform unsteady flow processes
 | * 1. Unsteady flow energy equation is derived according to prescribed thermodynamics guidelines
	2. Unsteady flow energy equation is applied in problem solving according to prescribed thermodynamics guidelines
 |
| 1. Understand perfect gases
 | * 1. ***Perfect gas laws*** are stated according to prescribed thermodynamics guidelines
	2. Gas laws experiment are carried out according to prescribed thermodynamics guidelines
	3. Gas laws are applied according to prescribed thermodynamics guidelines
 |
| 1. Generate steam
 | * 1. Dryness fraction is determined according to prescribed thermodynamics guidelines
	2. Relationship between pressure and boiling point is determined according to prescribed thermodynamics guidelines
	3. Energy balance is carried out according to prescribed thermodynamics guidelines
	4. Relationship between temperature and pressure is determined according to prescribed thermodynamics guidelines
 |
| 1. Perform thermodynamics reversibility and entropy
 | * 1. Thermodynamics reversibility is explained according to prescribed thermodynamics guidelines
	2. Principles of heat engine are explained according to prescribed thermodynamics guidelines
	3. Second law of thermodynamics is applied according to prescribed thermodynamics guidelines
	4. Entropy is explained in thermodynamics cycle according to prescribed thermodynamics guidelines
 |
| 1. Understand ideal gas cycle
 | * 1. Ideal gas cycle processes are explained according to prescribed thermodynamics guidelines
	2. Air standard efficiency and actual efficiency are differentiated according to prescribed thermodynamics guidelines
	3. Application problems are solved in ideal gas cycle according to prescribed thermodynamics guidelines
 |
| 1. Demonstrate fuel and combustion
 | * 1. Fuels are classified according to prescribed thermodynamics guidelines
	2. Properties of fuels are described according to prescribed thermodynamics guidelines
	3. Combustion equation are derived according to prescribed thermodynamics guidelines
	4. Combustion equation is applied to combustion and exhaust gas problems according to prescribed thermodynamics guidelines
 |
| 1. Perform heat transfer
 | * 1. Conduction equation is derived and applied from Fourier’s law according to prescribed thermodynamics guidelines
	2. Heat transfer equation is derived and applied from Newton’s law of cooling and Fourier’s law according to prescribed thermodynamics guidelines
	3. Heat exchangers are classified according to prescribed thermodynamics guidelines
	4. Recuperative heat exchangers are described according to prescribed thermodynamics guidelines
	5. Heat equations are applied to solve heat exchanger problems according to prescribed thermodynamics guidelines
 |
| 1. Understand air compressors
 | * 1. Air compressors are classified according to prescribed thermodynamics guidelines
	2. ***Types of air compressors*** are described according to prescribed thermodynamics guidelines
	3. Equations of reciprocating compressors are derived and applied according to prescribed thermodynamics guidelines
 |
| 1. Understand gas turbines
 | * 1. Theoretical cycle for gas turbines is explained according to prescribed thermodynamics guidelines
	2. Open cycle gas turbine is described according to prescribed thermodynamics guidelines
	3. Closed cycle gas turbine is described according to prescribed thermodynamics guidelines
	4. Gas turbine equations are derived and applied according to prescribed thermodynamics guidelines
 |
| 1. Understand impulse steam turbines
 | * 1. ***Principles of operations*** of the impulse steam turbines is described according to prescribed thermodynamics guidelines
	2. Impulse steam turbine equation is derived and applied according to prescribed thermodynamics guidelines
 |

**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** |
| Utilities may include but not limited to: | * + Boilers
	+ Condensers
	+ Compressors
	+ Nozzles
	+ Throttling processes
 |
| Perfect gas laws may include but not limited to: | * + Boyle’s law
	+ Charlee’s law
	+ Joule’s law
 |
| Principles may include but not limited to: | * + Newton’s laws of motion
	+ Law of conservation of linear momentum
	+ Law of conservation of energy
	+ Archimedes’ principle
 |
| Types of air compressors may include but not limited to: | * + Reciprocating
	+ Rotary
	+ Piston
 |

**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

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Newton’s law
* Levers
* Gear trains
* Laws of conservation of energy
* Laws of friction
* Type of forces
* Thermodynamics
* Calculation of fluid pressure and flow rate
* Mechanical advantage and efficiency calculations
* Gas laws
* SI units of mechanical energy.
* Power transmission systems
* Parameters of fluid system
* Operation of mechanical machines
* Mechanical calculation of power, energy, work done, torque and safety factor
* Units of measurement, conversions 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.

|  |  |
| --- | --- |
| 1. Critical aspects of Competency
 | Assessment requires evidence that the candidate: * 1. Identified Principles of mechanical science
	2. Performed mechanical calculations of a system
	3. Identified types of forces on a system
	4. Calculated resultant forces on plane framework
	5. Identified application of forces on the production flow
	6. Tested mechanical properties of a materials
	7. Identified tools and equipment for measuring system parameters
	8. Recorded and interpreted measured parameters.
	9. Operated Power transmission systems
 |
| 1. Resource Implications
 | The following resources should be provided: * 1. Access to relevant workplace or appropriately simulated environment where assessment can take place
	2. Measuring tools and equipment
	3. Sample materials to be tested
 |
| 1. Methods of Assessment
 | Competency in this unit may be assessed through: * 1. Direct Observation
	2. Demonstration with Oral Questioning
	3. Case studies
	4. Written tests
 |
| 1. Context of Assessment
 | Competency may be assessed individually in the actual workplace or through accredited institution  |
| 1. Guidance information for assessment
 | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY FLUID MECHANICS PRINCIPLES

**UNIT CODE:** ENG/OS/MPE/CC/05/5/A

**Unit description**

This unit describes the competencies required by a mechatronic technician in order to apply a wide range of fluid mechanics principles in their work. It includes understanding flow of fluids, demonstrating knowledge in viscous flow, performing dimensional analysis and operating fluid pumps

**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. Understand flow of fluids
 | * 1. Flow rate in pipes is measured according to work requirements
	2. Losses in pipes are determined according to work requirements
	3. ***Causes of losses*** in pipes are determined according to work requirements
	4. Flow losses equations are applied in problem solving according to prescribed fluid principles
 |
| 1. Demonstrate knowledge in viscous flow
 | * 1. Viscous flow between parallel surfaces are explained according to prescribed fluid principles
	2. Viscous flow equations between parallel surfaces are derived and applied according to prescribed fluid principles
	3. Viscous flow equations in circular pipes are derived and applied in problem solving according to prescribed fluid principles
 |
| 1. Perform dimensional analysis
 | * 1. Dimensional analysis is explained according to prescribed fluid principles
	2. Principle of dimensional homogeneity is explained according to prescribed fluid principles
	3. Fundamental dimensions are stated according to prescribed fluid principles
	4. Dimensional units are defined according to prescribed fluid principles
	5. ***Physical quantities*** are identified according to prescribed fluid principles
	6. Dimensional analysis is applied in problem solving according to prescribed fluid principles
 |
| 1. Operate fluid pumps
 | * 1. ***Principle of operation*** of pumps is described according to prescribed fluid principles
	2. Reciprocating pump equation is derivedaccording to prescribed fluid principles
	3. Centrifugal pump equation is derivedaccording to prescribed fluid principles
	4. Pump equations are applied in problem solving according to prescribed fluid principles
 |

**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** |
| Causes of losses may include but not limited to: | * + Friction
	+ Enlargement/reduction in cross-sectional areas
 |
| Physical quantities may include but not limited to: | * + Mass
	+ Force
	+ Density
	+ Velocity
	+ Acceleration
 |
| Principle of operation may include but not limited to: | * + Reciprocating
	+ Centrifugal
 |

**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

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Newton’s law
* Levers
* Gear trains
* Laws of conservation of energy
* Laws of friction
* Type of forces
* Thermodynamics
* Calculation of fluid pressure and flow rate
* Mechanical advantage and efficiency calculations
* Gas laws
* SI units of mechanical energy.
* Power transmission systems
* Parameters of fluid system
* Operation of mechanical machines
* Mechanical calculation of power, energy, work done, torque and safety factor
* Units of measurement, conversions 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.

|  |  |
| --- | --- |
| 1. Critical aspects of Competency
 | Assessment requires evidence that the candidate: * 1. Identified Principles of mechanical science
	2. Performed mechanical calculations of a system
	3. Identified types of forces on a system
	4. Calculated resultant forces on plane framework
	5. Identified application of forces on the production flow
	6. Tested mechanical properties of a materials
	7. Identified tools and equipment for measuring system parameters
	8. Recorded and interpreted measured parameters.
	9. Operated Power transmission systems
 |
| 1. Resource Implications
 | The following resources should be provided: * 1. Access to relevant workplace or appropriately simulated environment where assessment can take place
	2. Measuring tools and equipment
	3. Sample materials to be tested
 |
| 1. Methods of Assessment
 | Competency in this unit may be assessed through: * 1. Direct Observation
	2. Demonstration with Oral Questioning
	3. Case studies
	4. Written tests
 |
| 1. Context of Assessment
 | Competency may be assessed individually in the actual workplace orthrough accredited institution  |
| 1. Guidance information for assessment
 | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

#

# CORE UNITS OF COMPETENCY

## INSTALL MECHANICAL PLANT MACHINERY

**UNIT CODE:** ENG/OS/MPE/CR/01/5/A

**Unit description**

This unit covers the competencies required to install mechanical plant machineries. It involves competencies to observe occupational health and safety, obtain and utilize technical drawing, obtain work permit for authorization, prepare for installation, install plant machine, test and commission machine where applicable.

**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 occupational health and safety
 | * 1. ***Personal protective equipment*** (PPE) are used according to OSHA 2007
	2. ***Tools and equipment*** are stored and maintained correctly according to manufacturer’s specifications
	3. Tools and equipment are used correctly according to designated purpose and SOPs
	4. Workspace housekeeping is maintained according to Standard operating procedures (SOPs)
	5. Workplace is planned according to design specifications.
	6. Safety inductions are carried out according to OSHA 2007
	7. Safety signs are placed and observed according to OSHA 2007
 |
| 1. Obtain and utilize technical drawing
 | * 1. Specific work technical drawings are identified according to work requirements
	2. Technical drawings and geometric symbols are read and interpreted as per ***drawing standards***.
	3. ***Operation plan*** is produced as per the technical drawings.
 |
| 1. Obtain work permit for authorization
 | * 1. Copies of ***application documents*** are prepared and presented according to authorisation authority requirements
	2. Copies of application documents are certified according to authorisation requirements
	3. Application is paid according to authorisation requirements
	4. Copy of certified documents are presented to authority according to authorisation requirements
	5. Permit is obtained according to work requirements
 |
| 1. Prepare for installation
 | * 1. Availability of ***System installation requirements*** are confirmed with supplier according to installation guidelines
	2. Site is checked for correct location, dimension and levels etc. utilising appropriate *measuring equipment.*
	3. Non-compliance with specification is reported to appropriate authority.
	4. Alteration/correction is undertaken with approval of appropriate authority.
	5. All surfaces, materials and components are prepared for use.
	6. Installation tools and equipment are selected
 |
| 1. Install plant machine
 | 1. Work safety is observed and adhered to according to health and safety legislation and regulations
2. Relevant instructions/documentation for the installation is followed according to installation requirements
3. Installation manual is analysed according to work requirements
4. Installation tools and equipment to be checked for usability according to manual and legal requirements where applicable.
5. Installation, positioning and securing of machine is carried out using ***appropriate methods and techniques***
6. Connections to the components are carried out to ensure that they are properly secured according to installation manual and SOPs
7. Installation is ***checked*** and any adjustments are done in accordance with the specification
8. Waste items are disposed in a safe and environmentally acceptable manner according to safety and health regulations
9. Installation documentation is done according to SOPs
 |
| 1. Test and commission machine where applicable
 | * 1. Work safety is observed and adhered to according to health and safety legislation and regulations
	2. Relevant testing tools and equipment are identified according to system manuals
	3. Plant machine is tested according to system functionality specifications
	4. Calibration of parameters is done to achieve the desired results according to expected output and certified institutions where applicable.
	5. Required raw materials are availed according to production requirement.
	6. Operators are trained how to operate and maintain machines according to operation and maintenance manual
	7. Commissioning of the machine is done as per the system manuals and commissioning procedures.
 |

**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** |
| --- | --- |
| Personal protective equipment may include but not limited to: | * Goggles
* Ear muff
* Safety mask
* Helmets/head gear
* Safety boots/shoes
* Gloves
* Overall/dust coat
 |
| Tools and equipment may include but not limited to: | * Hand tools
* Power tools
* Machine(s)
* Tool box
* Handling equipment
 |
| Drawing standards may include but not limited to: | * ISO
* BS
* ANSI
 |
| Operation plan |  |
| Application documents may include but not limited to: | * Academic certificates
* Professional certificates
* Identification documents
* Legal documents
 |
| System installation requirements may include but not limited to: | * Power requirements
* Pneumatic requirements
* Housekeeping requirement e.g. waste clothes saw dust
* Communication cables
* Tools
* Equipment
 |
| Measuring equipment | * Steel rule
* Tape measure
 |
| Appropriate methods and techniques may include but not limited to: | * Marking out of locating and securing positions
* Levelling equipment
* Drilling and hole preparation
* Shimming and packing
* Fitting inserts (such as rag bolts or expanding bolts)
* Fitting anti-vibration mountings
* Positioning equipment
* Securing by using mechanical fixings
* Aligning equipment
* Applying screw fastener locking devices
* Make installation connections (such as mechanical, electrical, fluid power, utilities)
 |
| Checks may include but not limited to: | * Fill/replenish fluids, oil, or grease
* Make visual checks for completeness and freedom from damage
* Make `off-load' checks
* Ensure that locking devices are fitted to fasteners (as appropriate)
* Check level and/or alignment
* Ensure that moving parts are clear of obstruction and/or guarded
 |
| Machine /plant may include but not limited to: | * Rotating equipment and machinery such as pumps, blowers, compressors, drive units, etc.
* Production equipment and plant
* Process equipment,
* Plant and machinery
* Engineering plant
* Machine tools
 |

**REQUIRED KNOWLEDGE**

***The individual needs to demonstrate knowledge of:***

* Installation specification of the machine/plant
* Procedures to follow if the location, dimensions and/or levels of the site do not comply with the specifications
* Procedures for checking whether the installed machine/plant conforms to specifications
* Materials and components to be used in the installation of the machine/plant
* Applicable codes and standards
* Installation sequence
* Methods to locate, fix/fasten machine/plant
* Methods of lifting/moving machine/plant and components
* Techniques, tools and equipment to measure site and machine/plant installation
* Use and application of personal protective equipment
* Safe work practices and procedures
* Hazards and control measures associated with installing machine/plant, including housekeeping
* Safety practices and procedures
* Fasteners
* Joining methods and techniques
* Quality control procedures
* Tools and equipment
* Material handling
* Problem solving
* Data analysis and interpretation
* Interpretation of technical drawings
* Documentation
* Testing and inspection
* Isolation and lock-off procedure
* Permit-to-work procedure
* Hazards associated with installing mechanical equipment
* Basic principle of operation of the equipment being installed
* Methods of marking out the site for positioning the equipment
* Techniques used to position, align, level and adjust the equipment
* Methods of lifting, handling and supporting equipment
* Procedure for safe disposal of waste materials
* Identification of installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage, or contamination)

**REQUIRED SKILLS**

***The individual needs to demonstrate skills in:***

* Interpreting and following information on written job instructions, manufacturer specifications, standard operating procedures, charts, lists, reports and other applicable reference documents
* Interpreting layout drawings and specifications
* Checking and clarifying information
* Reporting – oral/written
* Planning and sequencing tasks
* Locating and verifying site and levels for installation
* Identifying non-compliances
* Preparing surfaces prior to commencing the installation
* Completing proformas, standard workplace forms, workplace reports and other applicable documents
* Checking for conformance to specifications
* Measuring to specified tolerances
* Performing numerical operations, geometry and engineering calculations/formulae within unit's scope
* Communication skills
* Problem solving
* Creativity and innovation
* Data collection and analysis
* Use of tools and equipment
* Technical presentation
* Technical drawing
* Installation and fabrication

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency.
 | * 1. Observed occupational health and safety
	2. Obtained and utilized technical drawing
	3. Obtained work permit for authorization
	4. Prepared for installation
	5. Installed plant machine
	6. Tested and commissioned machine
	7. Documented plant installation
 |
| 1. Resource Implications.
 | * 1. Computers
	2. Software
	3. Projectors
	4. Markers
	5. Whiteboards
	6. Tools and equipment
	7. Whiteboard markers
 |
| 1. Methods of Assessment.
 | ***Competency may be assessed through:**** 1. Practical
	2. Observation
	3. Questionnaire
	4. Case studies
	5. Written examinations
	6. Oral presentation
 |
| 1. Context of Assessment.
 | Competency may be assessed individually in an actual workplace or in work-simulated conditions within accredited institutions. |
| 1. Guidance information for assessment.
 | This unit may be assessed on an integrated basis with others within this occupational sector. |

## PERFORM PLANT MAINTENANCE

**UNIT CODE:** ENG/OS/MPE/CR/02/5/A

**Unit description**

This unit describes the competencies required by a technician to perform plant maintenance. It involves competencies required to inspect production plant, conduct breakdown maintenance, conduct preventive maintenance, conduct corrective maintenance, test and commission where applicable and document maintenance work done. \* Observation: the statement should be in present continuous tense

**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. Inspect production plant
 | * 1. Work safety is observed and adhered to according to health and safety *legislation and regulations*
	2. Inspection checklist is developed according to machine specifications
	3. Correct specification for the production plant being inspected is followed according to plant manual
	4. Correct equipment to carry out the inspection is used according to inspection manual
	5. Inspection checks to be made and acceptance criteria to be used is identified and confirmed according to plant requirements
	6. All required inspections as specified are carried out according to plant requirements
	7. Any defects or variations from the specification are identified and rectified if possible according to plant requirements
	8. Results of the inspection are recorded according to SOPs
 |
| 1. Identify maintenance needs
 | * 1. Work safety is observed and adhered to according to health and safety legislation and regulations\* omit as it’s not necessary for this element
	2. ***Maintenance types*** are defined according inspection results.
	3. Maintenance manuals are analysed according to work requirements
	4. ***Components*** to be maintained are identified according to system requirements
 |
| 1. Conduct breakdown maintenance
 | * 1. Work safety is observed and adhered to according to health and safety legislation and regulations
	2. Machine is switched off from power supply according to user manual.
	3. Appropriate signage is placed on both control and operation panel according to organization procedures.
	4. Machine is inspected according to work requirements
	5. Identified faulty assemblies are dismantled and marked for identification according to maintenance manual parts are lubricated according to manufacturer’s recommendation\*

\*revise the statement* 1. Maintained machine is tested according to manufacturer’s manual
	2. Maintenance records are updated according to SOPs
	3. Machine is handed over according to existing organizational policy.
 |
| 1. Conduct preventive maintenance
 | * 1. Work safety is observed and adhered to according to health and safety legislation and regulations
	2. All people/departments/sections affected by required preventive maintenance and their impact are notified according to organisational procedures
	3. Equipment is checked to be correctly set up for preventive maintenance according to maintenance manual
	4. Relevant data from technical or supporting manuals is accessed to assist with preventive maintenance according to organisation’s regulations
	5. Lubrication status of moving parts of the machine is done according to maintenance procedures
	6. Cleaning of components is carried out according to maintenance procedures
	7. Components are repainted according to maintenance manual
	8. Preventive maintenance of all components is performed according to maintenance schedule/protocol
	9. Instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule are reported according to organisation’s regulations
	10. Equipment is checked for functioning against expected operational parameters to confirm operational status according to operational manual
	11. Waste materials are disposed in accordance with safe working practices and approved procedures
	12. Relevant maintenance records are completed according to SOPs
	13. Machine is handed over according to existing organizational policy.
 |
| 1. Conduct corrective maintenance
 | * 1. Work safety is observed and adhered to according to health and safety legislation and regulations
	2. All people affected by required corrective maintenance and their impact are notified according to organisational procedures
	3. Equipment is checked to be correctly set up for corrective maintenance according to maintenance manual
	4. Relevant data from technical or supporting manuals is accessed to assist with corrective maintenance according to organisation’s regulations
	5. Fault diagnosis and identification is carried out according to work requirements
	6. Corrective maintenance of fault is performed according to maintenance schedule/protocol
	7. Waste materials are disposed in accordance with safe working practices and approved procedures
	8. Relevant maintenance records are completed according to SOPs.
	9. Machine is handed over according to existing organizational policy.
 |
| 1. Test and commission where applicable
 | * 1. Health and safety precautions are observed according to OSHA
	2. Relevant testing tools and equipment are identified according to system manuals
	3. Plant machine/equipment is tested and rectified where applicable according to system functionality specifications
	4. Calibration of parameters is done to achieve the desired results according to expected output
	5. Relevant maintenance records are completed according to SOPs
	6. Commissioning of the machine is done as per the system manuals
 |

**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** |
| --- | --- |
| Legislation and regulations |  |
| Tools and equipment may include but not limited to: | * Hand tools
* Power tools
* Machines
 |
| Maintenance types may include but not limited to: | * Preventive maintenance
* Corrective maintenance
* Condition-based maintenance
* Breakdown maintenance
 |
| Components may include but not limited to: | * Bearings
* Drives
* Couplings and linkages
* Conveyers
* Gears
 |

**REQUIRED KNOWLEDGE**

***The individual needs to demonstrate knowledge of:***

* Technical report writing
* PPE
* Site and equipment safety requirements
* Equipment and plant characteristics, technical capabilities and limitations
* Equipment and plant operational procedures
* Site equipment and plant maintenance procedures
* Site environmental requirements and constraints related to operational maintenance activities
* Interpretation of technical drawings
* Inspection methods and techniques
* Calibration of equipment
* Defects identification
* Types of tools and equipment
* Electrical and mechanical machine drives
* Machine operation
* Types of maintenance
* Manual interpretation
* Scheduling/planning for maintenance
* Performance parameters, principles of operation, capabilities and limitations of specified equipment
* Factors affecting decisions on maintenance activity
* Risks associated with unsafe or non-maintained equipment
* Waste disposal procedures
* Type and range of records required for maintenance of equipment
* Fault and error message diagnosis and appropriate actions
* Dissemination of maintenance plans
* Generation production plant and equipment, its location and operating parameters
* Legislation, industry standards, codes of practice and regulations
* Maintenance methods
* Maintenance plan development using maintenance planning philosophies and practices
* Maintenance plan implementation
* Manufacturers' specifications and manuals
* Quality control
* Risk management
* Typical arrangements of power production plant
* OHS legislated requirements including:
* Emergency procedures
* Risk control measures
* Safe working practices
* Workplace documentation
* Workplace policies and procedures

**REQUIRED SKILLS**

***The individual needs to demonstrate skills in:***

* Communication skills
* Problem solving
* Data collection and analysis
* Use of tools and equipment
* Technical drawing
* Service and repair of system components
* Fault diagnosis
* Basics on mechanical maintenance
* Use of test and measuring instruments
* Planning
* Organisation

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency.
 | * 1. Inspected production plant
	2. Identified maintenance needs
	3. Planned and prepared for plant operational maintenance
	4. Conducted breakdown maintenance
	5. Conducted preventive maintenance
	6. Conducted corrective maintenance
	7. Tested and commissioned where applicable
	8. Documented maintenance work done
 |
| 1. Resource Implications.
 | * 1. Computers
	2. Softwares
	3. Whiteboards
	4. Tools and equipment
	5. Whiteboard markers
	6. Manuals
 |
| 1. Methods of Assessment.
 | ***Competency may be assessed through:**** 1. Practical
	2. Observation
	3. Questionnaire
	4. Case studies
	5. Written examinations
	6. Oral presentation
 |
| 1. Context of Assessment.
 | Competency may be assessed individually in an actual workplace or in work-simulated conditions within accredited institutions. |
| 1. Guidance information for assessment.
 | This unit may be assessed on an integrated basis with others within this occupational sector. |

## MAINTAIN HYDRAULIC AND PNEUMATIC SYSTEMS

**UNIT CODE:** ENG/OS/MPE/CR/03/5/A

**Unit description**

This unit covers the competencies required to maintain hydraulic and pneumatic systems. It involves competencies to observe occupational health and safety, repairing hydraulic and pneumatic systems, testing and commissioning hydraulic and pneumatic systems where applicable and record maintenance report.

**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 occupational health and safety
 | * 1. ***Personal protective equipment*** (PPE) are used according to OSHA 2007
	2. ***Tools and equipment*** are stored and maintained correctly according to manufacturer’s specifications
	3. Tools and equipment are used correctly according to designated purpose
	4. Workspace housekeeping is maintained according to Standard operating procedures (SOPs)
	5. Workplace is planned according to design specifications.
	6. Safety signs are placed and observed according to OSHA 2007
 |
| 1. Repair hydraulic and pneumatic systems where applicable
 | * 1. Service manual is analysed according to work requirements
	2. Tools and equipment are selected and checked to be in usable condition according to user manual
	3. System is switched off where applicable according to safety standards.
	4. Components are repaired according to the service manual and specifications
	5. Defects are rectified in accordance with manufacturer’s procedure.
	6. System repairs are documented according to SOPs
 |
| 1. Test and commission hydraulic and pneumatic systems
 | * 1. ***Peripheral devices*** are verified if they are properly connected according to system manual
	2. Peripheral devices functionality is verified according to system manual
	3. Oil ***validity*** is verified according prescribed system requirements
	4. Fluid leakages are checked according to prescribed oil leakage checking methods
	5. ***Testing equipment*** are selected and operated correctly according to manufacturer’s specifications
	6. Oil flow is tested according to design specifications
	7. Instruments and controllers are tested according to system requirements
 |

**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** |
| --- | --- |
| Tools and equipment may include but not limited to: | * Hand tools
* Power tools
* Machines
 |
| Personal protective equipment may include but not limited to: | * Goggles
* Ear muff
* Safety mask
* Helmets/head gear
* Safety boots
* Gloves
* Overall/dust coat
 |
| System fault classification may include but not limited to: | * Reservoir fluid level indicator indicates below full
* Filter differential pressure indicator button up
* System fluid pressure fails to deplete
 |
| Documents and publications may include but not limited to: | * Purchasing documents
* Hydraulic/pneumatic manufacturers
* Parts venders
* Structural Repair Manual
* Installation manual
 |
| Peripheral devices may include but not limited to: | * Pipes/tubes/hoses
* Gauges
* Valves
* Instruments
* Sensors
* Pumps
* Reservoirs
* Compressors
* Regulators
* Filters
* Seals
* Power units
 |
| Validity may include but not limited to: | * Pressure
* Temperature
* Contamination/impurities
* Viscosity
* Density
* Fluid life cycle
 |
| Testing equipment may include but not limited to: | * Leakage tester/detector
* Instruments /gauges
 |

**REQUIRED KNOWLEDGE**

***The individual needs to demonstrate knowledge of:***

* Pneumatic and hydraulic fluids
* Pneumatic and hydraulic power generation
* Emergency generation of pneumatic and hydraulic power
* Force; pressure; area; differential areas
* Fluid requirements: properties; types; identification; hazards
* Power generation methods — main system; emergency standby system
* Technical report writing
* Data analysis and interpretation
* Interpretation of technical drawings
* Documentation
* Types of tools and equipment
* Electrical and mechanical machine drives
* Testing and inspection
* Common hydraulic system components
* Hydraulic/pneumatic system/component faults that can be determined by visual inspection
* The application of common hydraulic system/component test equipment
* Schedule of preventative maintenance tasks
* The manufacturers' specifications
* Common hydraulic system and component faults
* Any previous faults in the hydraulic system/components
* Any previous maintenance carried out on the hydraulic system/components
* Typical checks/tests that can be carried out on hydraulic systems/components and their application
* Hydraulic system/component test and testing techniques
* Apparent faults/malfunctions
* The documentation/reporting requirements with respect to verified faults/malfunctions
* The procedures for initiating repair/replacement and/or overhaul of the hydraulic system
* The hazards and control measures associated with working on hydraulic systems/components, including housekeeping
* The procedures for isolating and depressurising hydraulic systems
* Tagging requirements for isolated systems
* The structure of typical hydraulic components
* The specifications of hydraulic components and their constituent parts
* The appropriate repair/overhaul procedures
* System decommissioning procedures
* The hydraulic and pneumatic system operational specifications
* Any appropriate follow-up maintenance or operational checks
* The maintenance recording/reporting requirements
* The consequences of inaccurate or incomplete recording/reporting of maintenance/service activities
* Safe work practices and procedures

**REQUIRED SKILLS**

***The individual needs to demonstrate skills in:***

* Communication skills
* Problem solving
* Creativity and innovation
* Data collection and analysis
* Use of tools and equipment
* Technical presentation
* Technical drawing
* Installation of hydraulic and pneumatic machines
* Interpretation of installation manuals
* Service and maintenance of hydraulic and pneumatic machines
* Preparing hydraulic system components for inspection/preventative maintenance
* Inspecting and testing the hydraulic system/components
* Planning and sequencing operations
* Performing scheduled preventative maintenance tasks
* Where appropriate, performing obvious repairs on the hydraulic system/components
* Visually inspect the hydraulic system and its components for indications of correct/incorrect operation
* Where appropriate, consulting with the system operator with respect to the fault being investigated
* Obtaining and interpreting maintenance reports and preventative maintenance schedules
* Using appropriate test equipment and techniques to check/test hydraulic system/component operation
* Verifying apparent faults/malfunctions
* Documenting or reporting all verified faults/malfunctions
* Initiating the repair/overhaul of the hydraulic system
* Isolating and depressurising the hydraulic system
* Tagging the isolated hydraulic system
* Removing the hydraulic components/sub-assembly from the system
* Dismantling the hydraulic components/sub-assemblies
* Examining the hydraulic components/sub-assemblies and their parts for conformance to specification
* Selecting replacement parts from manufacturers' catalogues in compliance with specifications
* Repairing/replacing/overhauling faulty items
* Refitting the hydraulic component/sub-assembly into the system
* Testing the hydraulic component/sub-assembly for correct operation and compliance with specifications
* Re-commissioning the hydraulic system/sub-assembly to specification
* Checking/testing the hydraulic system/sub-assembly for correct operation
* Where appropriate, initiating follow-up procedures
* Updating and completing all maintenance records/reports

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency.
 | * 1. Observed occupational health and safety
	2. Did troubleshoot hydraulic and pneumatic systems
	3. Identified and obtained spare parts
	4. Repaired hydraulic and pneumatic systems
	5. Tested and commissioned hydraulic and pneumatic systems
	6. Recorded and generated maintenance report
 |
| 1. Resource Implications.
 | * 1. Computers
	2. Softwares
	3. Projectors
	4. Markers
	5. Whiteboards
	6. Tools and equipment
	7. Whiteboard markers
 |
| 1. Methods of Assessment.
 | Competency may be assessed through:* 1. Practical
	2. Observation
	3. Questionnaire
	4. Case studies
	5. Written examinations
	6. Oral presentation
 |
| 1. Context of Assessment.
 | Competency may be assessed individually in an actual workplace or in work-simulated conditions within accredited institutions. |
| 1. Guidance information for assessment.
 | This unit may be assessed on an integrated basis with others within this occupational sector. |

## OPERATE PLANT MACHINES/UTILITIES

**UNIT CODE:** ENG/OS/MPE/CR/04/5/A

**Unit description**

This unit describes the competencies required by a technician in order to observe occupational health and safety, handle raw materials, set machine parameters, operate plant machine, control product quality, carry out autonomous maintenance, record and generate production reports and store raw materials and finished products.

**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 occupational health and safety
 | * 1. ***Personal protective equipment*** (PPE) are used according to OSHA 2007
	2. Tools and equipment are stored and maintained correctly according to manufacturer’s specifications
	3. ***Tools and equipment*** are used correctly according to designated purpose
	4. Workspace housekeeping is maintained according to Standard operating procedures (SOPs)
	5. Workplace is planned according to design specifications.
	6. Safety signs are placed and observed according to OSHA 2007
 |
| 1. Handle raw materials
 | * 1. Work safety is observed and adhered to according to health and safety legislation and regulations.
	2. Unwanted materials/objects are removed from delivered raw materials as prescribed in health and safety regulations
	3. Raw materials are requested internally where applicable according to organizational policy
	4. Raw materials are transferred to storage areas as prescribed in organisation’s regulations
	5. Material handling machinery is inspected according to manuals
	6. Material handling machinery is operated according to user manual
	7. Hazardous materials are handled with caution as prescribed in handling manual
 |
| 1. Set machine parameters
 | * 1. Machine safety functions are established as per manufacturer’s specification.
	2. Raw materials are identified according to production requirements
	3. Finished product is identified as per customer requirement
	4. Machine parameters are set according to product requirement.
 |
| 1. Operate plant machine
 | * 1. Work safety is observed and adhered to according to health and safety legislation and regulations
	2. Plant machines are visually inspected according to workplace policy
	3. Machinery is switched on as prescribed in user manual
	4. ***Lifting equipment*** operated according to operation manual and work specification
	5. Links, joints and other protruding parts go back to their resting position\* as per manufacturer’s requirements.

\* revise the statement * 1. Machinery is switched off according to user manual
 |
| 1. Control product quality
 | * 1. Production manual is analysed according to work requirements
	2. ***Production parameters*** are set as prescribed in product manual
	3. Products are produced according to work requirements
	4. Products are inspected against set parameters as prescribed in production manual
	5. Defective products are isolated as per production manual
 |
| 1. Carry out autonomous maintenance
 | * 1. Work safety is observed and adhered to according to health and safety legislation and regulations
	2. Approval for use of the appropriate spare is obtained according to organisation’s regulations
	3. Autonomous Maintenance is carried out according to work requirements
	4. Overall Equipment Effectiveness (OEE) measure and information to determine which elements of the OEE and their associated losses need improvement is used according to organisation’s prescribed regulations
	5. Action plan that will reduce/eliminate the losses and hence improve the Overall Equipment Effectiveness is used according to maintenance procedures
	6. Improvements to working practices through Autonomous Maintenance are implemented according to maintenance procedures
 |
| 1. Record production data
 | * 1. Information and data to be reported is identified according to production requirements
	2. Method of recording information and data is identified in accordance with company procedures
	3. Production information and data is recorded according to company procedures
	4. Records are processed and stored in accordance with company procedures
 |
| 1. Store finished products.
 | * 1. Finished products are recorded in appropriate documents according to company procedures
	2. Storage section is kept clean in accordance with health and safety regulations
	3. Finished products are stored in special conditions as prescribed in health and safety regulations and nature of products.
	4. Other materials and finished products are stored in accordance with health and safety regulations
 |

**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** |
| --- | --- |
| Tools and equipment may include but not limited to: | * Hand tools
* Power tools
* Machines
 |
| Personal protective equipment may include but not limited to: | * Goggles
* Ear muff
* Safety mask
* Helmets/head gear
* Safety boots
* Gloves
* Overall/dust coat
 |
| Lifting equipment | * Cranes
* Chain blocks
* Forklift
* Hoist
 |
| Production parameters may include but not limited to: | * Size
* Production time
* Colour
* Texture
 |
| legislation and regulations |  |

**REQUIRED KNOWLEDGE**

***The individual needs to demonstrate knowledge of:***

* Safety regulations
* Material handling
* Hazards in material handling
* Principles of Autonomous Maintenance
* Total Productive Maintenance
* Over all Equipment Effectiveness (OEE)
* Standards of wear
* contaminants and sources of contaminants
* Documentation
* Scheduling/planning for maintenance
* Machining techniques where the positioning of the work may be controlled by machine guides or work markers or where there is uncomplicated feeding of material
* Machine operating procedures
* Characteristics of typical leathers, fabrics, threads and other materials used in assembly and machining of uppers
* Quality standards and practices
* Safety and environmental aspects of relevant upper assembly and machining processes
* OHS practices, including hazard identification and control measures
* Workplace practices
* Recording and reporting practices

**REQUIRED SKILLS**

***The individual needs to demonstrate skills in:***

* Communication skills
* Problem solving
* Data collection and analysis
* Total Productive Maintenance
* Overall Equipment Effectiveness (OEE)
* Fault diagnosis
* Attention to details
* Handle, receive and assemble machine consumables, spares and raw materials
* Read, interpret and follow information on work specifications, standard operating procedures and work instructions, and other reference material
* Maintain accurate records
* Communicate in the workplace
* Sequence operations
* Meet specifications
* Clarify and check task-related information
* Carry out work according to OHS practices

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency.
 | * 1. Observed occupational health and safety
	2. Handled raw materials
	3. Set machine parameters
	4. Operated plant machine
	5. Controlled product quality
	6. Carried out autonomous maintenance
	7. Recorded and generated production reports
	8. Stored raw materials and finished products.
 |
| 1. Resource Implications.
 | * 1. Computers
	2. Software
	3. Whiteboards
	4. Whiteboard markers
	5. Manuals
 |
| 1. Methods of Assessment.
 | ***Competency may be assessed through:**** 1. Practical
	2. Observation
	3. Questionnaire
	4. Case studies
	5. Written examinations
	6. Oral presentation
 |
| 1. Context of Assessment.
 | Competency may be assessed individually in an actual workplace or in work-simulated conditions within accredited institutions. |
| 1. Guidance information for assessment.
 | This unit may be assessed on an integrated basis with others within this occupational sector. |

## MANAGE SPARES AND CONSUMABLES INVENTORY

**UNIT CODE:** ENG/OS/MPE/CR/05/5/A

**Unit description**

This unit describes the competencies required by a technician to manage spares and consumables inventory. It involves competencies to observe occupational health and safety, store received spares/consumables, carry out stock taking and record inventory.

**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 occupational health and safety
 | * 1. ***Personal protective equipment*** (PPE) and ***firefighting equipment*** are used according to OSHA 2007
	2. Tools and equipment are stored and maintained correctly according to manufacturer’s specifications
	3. ***Tools and equipment*** are used correctly according to designated purpose
	4. Workspace housekeeping is maintained according to Standard operating procedures (SOPs)
	5. Safety signs are placed and observed according to OSHA 2007
 |
| 1. Store received spares/consumables/products
 | * 1. Received spares/consumables are labelled and tagged according to organisation’s regulations
	2. Bin cards are generated according to organization’s policy.
	3. Goods received note is raised as per company policy.
	4. Storage location is cleaned according to health and safety regulations
	5. Products are recorded according to company procedures.
	6. Storage conditions are kept as prescribed in storage manual
	7. Hazardous and fragile products are stored in special conditions as prescribed in health and safety regulations
	8. Other materials and finished products are stored in accordance with health and safety regulations
 |
| 1. Issue spares and consumables
 | * 1. Requisition from the user is obtained/received according to organizational procedures.
	2. Spare/consumable to issued is identified according to store setup
	3. Spare/consumables is issued according to store procedures.
	4. Records are updated according to organizational procedures.
 |
| 1. Carry out stock taking
 | * 1. Stock is counted and confirmed to verify available physical quantities according to organisation’s requirements
	2. ***Labelling/tagging information***\*on products is checked according to products catalogue
	3. Stock date is tagged on products according to organizational procedures.
	4. Requirements to replenish stock is recorded according to organisation’s requirements
	5. Damaged spares and consumables are disposed according to organizational policy and safety regulations.
	6. Stock records are updated according to organisation’s policy

\* not in the range as implied |
| 1. Record inventory report
 | * 1. Reorder level reports are generated according to organizational policy.
	2. Daily inventory information is recorded according to organisation’s requirements
 |

**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** |
| --- | --- |
| Personal protective equipment may include but not limited to: | * Goggles
* Ear muff
* Safety mask
* Helmets/head gear
* Safety boots
* Gloves
* Overall/dust coat
 |
| Fire fighting equipment may include but not limited to: | * Fire extinguisher
* Hose reels
* Fire blanket
* Fire alarm
 |
| Tools and equipment may include but not limited to: | * Hand tools
* Power tools
 |
| Impact of equipment failure may include but not limited to:\*\* not in the main body – list of elements and PCs | * Customer orders,
* Time to production disruption,
* Employee safety,
* Environment,
* The ability to isolate the failed equipment,
* Equipment history of mean-time-between-failures (MTBF)
* PM/PDM history and the overall predictability of failure
 |
| Supplier performance may include but not limited to: | * Quality,
* Timeliness
* Reliability
 |
| Packaging information may include but not limited to: | * Batch numbers
* Safety data sheets
* Volumes
* Expiry dates
* Delivery dates
* Weights
* Quantities
* Hazard labels
* Condition received
 |
| Labelling/tagging information |  |

**REQUIRED KNOWLEDGE**

***The individual needs to demonstrate knowledge of:***

* Organisational procedures and legal and ethical requirements
* Procurement process
* Product selection
* Presentation
* Integrity
* Data analysis and interpretation
* Documentation
* Consistency in decision-making
* Stock taking
* Inventory
* Human resource management

**REQUIRED SKILLS**

***The individual needs to demonstrate skills in:***

* Negotiation
* Documentation
* Problem solving
* Analysis
* Listening
* consistency in decision-making
* Integrity
* Presentation
* Assessing
* Communicating
* Consulting
* Decision-making
* Evaluating
* Influencing
* interaction

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency.
 | * 1. Observed occupational health and safety
	2. Identified critical spares and consumables
	3. Procured spares and consumables
	4. Inspected ordered spares and consumables
	5. Stored received spares/consumables
	6. Carried out stock taking
	7. Managed store human resource\*
	8. Reorder level for stock replenishing
	9. Recorded and generated inventory report

\* 1.7 not a critical aspect, replace with reorder level aspect |
| 1. Resource Implications.
 | * 1. Computers
	2. Software
	3. Whiteboards
	4. Whiteboard markers
	5. Manuals
 |
| 1. Methods of Assessment.
 | ***Competency may be assessed through:**** 1. Practical
	2. Observation
	3. Questionnaire
	4. Written examinations
	5. Oral presentation
 |
| 1. Context of Assessment.
 | Competency may be assessed individually in an actual workplace or in work-simulated conditions within accredited institutions. |
| 1. Guidance information for assessment.
 | This unit may be assessed on an integrated basis with others within this occupational sector. |

## PERFORM WORKSHOP PROCESSES

**UNIT CODE:** ENG/OS/MPE/CR/06/5/A

**Unit description**

This unit describes the competencies required by a technician to perform workshop processes. It involves competencies toobserve occupational safety, perform sheet metal works, carry out metal joining processes, operate lathe machines, perform mechanical bench works, operate milling machines, operate grinding machine, operate hand tools, operate drilling machine and perform foundry works.

**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 occupational safety
 | * 1. ***Personal protective equipment*** (PPE) are used according to OSHA 2007
	2. Tools and equipment are stored and maintained correctly according to manufacturer’s specifications
	3. ***Tools and equipment*** are used correctly according to SOPs
	4. Workspace housekeeping is maintained according to Standard operating procedures (SOPs)
	5. Workplace is planned according to design specifications.
	6. Safety signs are placed and observed according to OSHA 2007
 |
| 1. Perform sheet metal works
 | * 1. Technical drawings are interpreted according to work specifications
	2. Tools and equipment are selected according to work specifications
	3. Work piece is marked according to work specifications
	4. Work piece is cut according to work specifications
	5. Parts are folded using bending/rolling machine according to work specifications
	6. Products are inspected according to work specifications
 |
| 1. Carry out metal joining processes
 | * 1. Surfaces are prepared for joining according to work specifications
	2. Parts are joined by riveting according to work specifications
	3. Parts are joined by ***welding*** according to work specifications
	4. Parts are joined by bolting according to work specifications
	5. Parts are joined by seaming according to work specifications
	6. Parts are joined by screwing according to work specifications
	7. Parts are joined by adhesives
	8. ***Finishing processes*** are carried on joined parts as per work specifications.
	9. Joints are inspected according to work requirements
 |
| 1. Operate lathe machines
 | * 1. Technical drawings are interpreted according to work specifications
	2. Cutting tools are selected according to work requirements
	3. Cutting tools are prepared according to work requirements
	4. Work piece is mounted on the lathe machine according to work specifications.
	5. Lathe machine is set for operation according to work requirements
	6. Parts are produced according to work requirements
 |
| 1. Perform mechanical bench works
 | * 1. Technical drawings are interpreted according to work specifications
	2. Work piece is marked out according to work requirement
	3. Work piece is set according to work requirement
	4. Tools and equipment are selected according to work requirement
	5. Parts are produced by various ***methods*** according to work requirement
 |
| 1. Operate milling machines
 | * 1. Technical drawings are interpreted according to work specifications
	2. Milling machine is set according to work specifications
	3. Work piece is mounted according to work specifications.
	4. Cutting tools are selected according to work specifications
	5. Cutting parameters are set according to work specifications
	6. Parts are produced according to work specifications
	7. Work quality is assessed according to work specifications
 |
| 1. Operate grinding machine
 | * 1. Technical drawings are interpreted according to work specifications
	2. Grinding wheel is ***selected*** according work requirements
	3. Work piece is mounted according to work specifications
	4. Work piece is ground according to work specifications
	5. Work piece is assessed according to work specifications
 |
| 1. Use hand tools
 | * 1. ***Hand tools*** are selected according to work specification
	2. Hand tools are inspected according to manufacturer’s manual
	3. Hand tools are utilised according user manual
	4. Hand tools are cleaned stored according to prescribed guidelines
 |
| 1. Operate hydraulic press
 | * 1. Occupational health and safety are observed according to OSHA 2007
	2. Work requirements are obtained from user according to organizational procedures.
	3. Hydraulic press is turned on and correct working pressure is set according to work requirements.
	4. Jigs and fixtures are mounted to hold the work piece according to work requirements.
	5. Hydraulic press is operated according to manufacturer manual.
	6. Hydraulic press is switched off according to manufacturer manual.
 |
| 1. Operate shaper machine
 | * 1. Technical drawings are interpreted according to work specifications
	2. Shaper machine is set according to work specifications
	3. Work piece is mounted according to work specifications.
	4. Cutting tools are selected according to work specifications
	5. Cutting parameters are set according to work specifications
	6. Parts are produced according to work specifications
	7. Work quality is assessed according to work specifications
 |
| 1. Operate power hacksaw
 | * 1. Occupational, health and safety is observed according to OSHA
	2. Blade condition is checked according to machine manual.
	3. Work piece is mounted and clamped according to user manual.
	4. Machine is operated in accordance with machine manual.
	5. Lubricant is applied where possible in accordance with material being cut.
	6. Machine is switched off on job completion in accordance with user manual
 |
| 1. Operate drilling machine
 | * 1. Technical drawings are interpreted according to work specifications
	2. Work piece is mounted according to work specifications.
	3. Drilling tool prepared according to work specifications
	4. Drilling machine is set according to work specifications
	5. Parts are drilled according to work specifications
	6. Work quality is assessed according to work specifications
 |
| 1. Perform foundry works
 | * 1. Technical drawings are interpreted according to work specifications
	2. Mould is inspected according to work requirement
	3. Furnace is inspected according to maintenance manual
	4. Raw materials are inspected according to purchase order
	5. Raw materials are melted in the furnace according to job specifications
	6. Molten metal is poured in mould according to work requirements
	7. Moulds is removed according to prescribed procedures
	8. Casting is shake out according to prescribed procedures
	9. Cast metal is cleaned according to prescribed procedures
	10. Cast metal is inspected according to prescribed procedures
	11. ***Finishing processes*** are done according to prescribed procedures
	12. Waste products are disposed according to prescribed procedures
 |

**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** |
| --- | --- |
| Tools and equipment may include but not limited to: | * Hand tools
* Power tools
 |
| Welding may include but not limited to: | * Arc
* Gas
 |
| Finishing processes may include but not limited to: | * Painting
* Grinding
 |
| Personal protective equipment may include but not limited to: | * Goggles
* Ear muff
* Safety mask
* Helmets/head gear
* Safety boots
* Gloves
* Overall/dust coat
 |
| Joining methods may include but not limited to: | * Riveting
* Seaming
* Bolting
* Screwing
* Welding
 |
| Cutting parameters may include but not limited to: | * Cutting speed
* Feed
 |
| Bench work production methods may include but not limited to: | * Sawing
* Hand drilling
 |
| Grinding wheel preparation may include but not limited to: | * Dressing
* Balancing
 |
| Hand tools may include but not limited to: | * Files
* Chisels
* Screwdrivers
* Knives and cutting tools
* Wrenches
 |
| Finishing processes may include but not limited to: | * Abrasives
* Grinders
* Presses
* Shot
 |

**REQUIRED KNOWLEDGE**

***The individual needs to demonstrate knowledge of:***

* Basic Mathematics & Science
* Metallurgy and materials
* Occupational Health& Safety
* Machine Maintenance
* Machining process
* Standards and symbols (ISO & EN)
* Grinding
* Milling, milling centers
* Turning, lathe centers
* Bending
* Joining
* Planning
* Drilling – Different types of making holes
* Raw material and final parts inspection
* Methods of Welding
* Technical language
* Machine Parts
* Automation and Technology
* Drawing and Design/CAD /CAM/
* Solid works/Inventor
* Organizing work area
* EDM-wire cutter
* CNC Machining

**REQUIRED SKILLS**

***The individual needs to demonstrate skills in:***

* Communication
* Welding
* Turning
* Grinding
* Measurement
* Metal cutting
* Brazing
* Tapping
* Soldering
* Milling
* Drilling
* Riveting
* Planning
* Sketching and drawing
* Inspection
* Forging
* Computer

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency.
 | * 1. Observed occupational safety
	2. Performed sheet metal works
	3. Carried out metal joining processes
	4. Operated lathe machines
	5. Performed mechanical bench works
	6. Operated milling machines
	7. Operated grinding machine
	8. Operated hand tools
	9. Operated drilling machine
	10. Performed foundry works
 |
| 1. Resource Implications.
 | * 1. Computers
	2. Software
	3. Whiteboards
	4. Whiteboard markers
	5. Manuals
 |
| 1. Methods of Assessment.
 | ***Competency may be assessed through:**** 1. Practical
	2. Observation
	3. Questionnaire
	4. Case studies
	5. Written examinations
	6. Oral presentation
 |
| 1. Context of Assessment.
 | Competency may be assessed individually in an actual workplace or in work-simulated conditions within accredited institutions. |
| 1. Guidance information for assessment.
 | This unit may be assessed on an integrated basis with others within this occupational sector. |