

**REPUBIC OF KENYA**

**NATIONAL OCCUPATIONAL STANDARDS**

**FOR**

**PLANT AND SERVICE ARTISAN**

**LEVEL 3**



TVET CDACC

P.O BOX 15745-00100

NAIROBI

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**Council Secretary/CEO**

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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 blue print and sustainable development goals.

Reforms in the education sector are necessary for the achievement of Kenya Vision 2030 and meeting the provisions of the Constitution of Kenya 2010. The education sector had to be aligned to the Constitution and this resulted to the formulation of the Policy Framework for Reforming Education and Training. 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 a Plant and Service Level 3. 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 plant mechanic sector’s growth and sustainable development.

**PRINCIPAL SECRETARY, VOCATIONAL AND TECHNICAL TRAINING MINISTRY OF EDUCATION**

**PREFACE**

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 a Plant and Service Artisan. These standards will be the bases for development of a competency-based curriculum for plant and service Level 5. These Standards will also be the bases for assessment of an individual for competence certification.

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, Plant Mechanic SSAC, expert workers and all those who participated in the development of these National Occupational standards.

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

**CHAIRMAN, TVET CDACC**

**ACKNOWLEDGMENT**

These Occupational Standards were developed through combined effort of various stakeholders from private and public organizations. I am sincerely 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 the Plant mechanic 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 validation of these Standards including those from Standard.

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

**CHAIRPERSON PLANT MECHANIC ENGINEERING SECTOR SKILLS ADVISORY COMMITTEE**

TABLE OF CONTENT

[FOREWORD ii](#_Toc29819118)

[PREFACE iii](#_Toc29819119)

[ACKNOWLEDGMENT iv](#_Toc29819120)

[ACRONYMS vi](#_Toc29819121)

[KEY TO UNIT CODE vii](#_Toc29819122)

[OVERVIEW viii](#_Toc29819123)

[BASIC UNITS OF COMPETENCY 1](#_Toc29819124)

[DEMONSTRATE COMMUNICATION SKILLS 2](#_Toc29819125)

[DEMONSTRATE DIGITAL LITERACY 5](#_Toc29819126)

[DEMONSTRATE ENTREPRENEURIAL SKILLS 9](#_Toc29819127)

[DEMONSTRATE EMPLOYABILITY SKILLS 14](#_Toc29819128)

[DEMONSTRATE ENVIRONMENTAL LITERACY 19](#_Toc29819129)

[DEMONSTRATE OCCUPATIONAL SAFETY AND HEALTH PRACTICES 22](#_Toc29819130)

[COMMON UNITS OF COMPETENCY 26](#_Toc29819131)

[APPLY MATHEMATICS 27](#_Toc29819132)

[PERFORM WORKSHOP PROCESS AND MATERIAL 32](#_Toc29819133)

[APPLY MECHANICAL SCIENCE PRINCIPLES 37](#_Toc29819134)

[APPLY MATERIAL SCIENCE AND METALLURGICAL PROCESSES 42](#_Toc29819135)

[APPLY ELECTRICAL PRINCIPLES 47](#_Toc29819136)

[PREPARE AND INTERPRET TECHNICAL DRAWINGS 50](#_Toc29819137)

[CORE COMPETENCIES 54](#_Toc29819138)

[PERFORM GENERAL OPERATION AND MAINTENANCE OF PLANT MACHINERY 55](#_Toc29819139)

[PERFORM GENERAL MAINTENANCE OF REFRIGERATION AND AIR CONDITIONING SYSTEMS 58](#_Toc29819140)

[PERFORM GENERAL PLANT MAINTENANCE 61](#_Toc29819141)

**ACRONYMS**

CDACC Curriculum Development, Assessment and Certification Council

EBK Engineers Board of Kenya

EBP Engineering best practice

EHS Environment, Health and Safety

IEE Institute of Electrical Engineers

IBMS Integrated Building Management System

KEBS Kenya Bureau of Standards

NCA National Construction Authority

OSHA Occupational Safety and Health Act

PPE Personal Protective Equipment

TVET Technical and Vocational Education and Training

SOP Standard operating procedure

WIBA Work injury benefits Act

ENG Engineering

OS Occupational Standards

CR Core units

PS Plant and Service

BC Basic Competencies

CC Common Competencies

CR Core Competencies

A Control version

**KEY TO UNIT CODE**

ENG/OS/PS/BC/01/3/A

Industry or sector

Occupational Standards

Occupational area

Type of competency

Competency number

Competency level

Control Version

# OVERVIEW

Plant and service Level 3 qualification consists of competencies that a person must achieve to enable him/her to be certified as a plant and service Artisan.

A plant and service Artisan is a person who will carry out various plant mechanic duties as stipulated in this curriculum

Thus, the units of competency comprising plant and service engineering Artisan level 3 qualifications include the following basic, common core competencies:

**BASIC COMPETENCIES**

|  |  |
| --- | --- |
| **Unit of Competency Code** | **Unit of Competency Title** |
| ENG/OS/PS/BC/01/3/A | Demonstrate communication skills |
| ENG/OS/PS/BC/02/3/A | Demonstrate digital literacy |
| ENG/OS/PS/BC/03/3/A | Demonstrate entrepreneurial skills |
| ENG/OS/PS/BC/04/3/A | Demonstrate employability skills |
| ENG/OS/PS/BC/05/3/A | Demonstrate environmental literacy |
| ENG/OS/PS/BC/06/3/A | Demonstrate occupational safety and health practices |

**COMMON COMPETENCIES**

|  |  |
| --- | --- |
| **Unit of Competency Code** | **Unit of Competency Title** |
| ENG/OS/PS/CC/01/3/A | Apply mathematics |
| ENG/OS/PS/CC/02/3/A | Perform workshop processes and materials |
| ENG/OS/PS/CC/03/3/A | Apply mechanical science principles |
| ENG/OS/PS/CC/05/3/A | Apply material science and metallurgical processes |
| ENG/OS/PS/CC/06/3/A | Apply Electrical principles |
| ENG/OS/PS/CC/07/3/A | Prepare and Interpret technical drawing |

**CORE COMPETENCIES**

|  |  |
| --- | --- |
| **Unit of Competency Code** | **Unit of Competency Title** |
| ENG/OS/PS/CR/01/3/A | Perform general operation and maintenance of plant machinery |
| ENG/OS/PS/CR/02/3/A | Perform general maintenance of refrigeration and air conditioning systems |
| ENG/OS/PS/CR/03/3/A | Perform general plant maintenance |

**BASIC UNITS OF COMPETENCY**

# DEMONSTRATE COMMUNICATION SKILLS

**UNIT CODE:** ENG/OS/PS/BC/01/3/A

**UNIT DESCRIPTION**

This unit specifies the competencies required to demonstrate communication skills. It involves, obtaining and conveying workplace information, speaking English at a basic operational level, participating in workplace meetings and discussions and completing relevant work-related documents.

**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. Obtain and convey workplace information | * 1. Specific and relevant information is accessed from ***appropriate sources***   2. Effective questioning, active listening and speaking skills are used to gather and convey information   3. Appropriate ***medium*** is used to transfer information and ideas   4. Appropriate non- verbal communication is used   5. Appropriate lines of communicationwith supervisors and colleagues are identified and followed   6. Defined workplace procedures for the location and ***storage*** of information are used   7. Personal interaction is carried out clearly and concisely |
| 1. Speak English at a basic operational level | * 1. Simple conversations on familiar topics with work colleagues is participated   2. Simple verbal instructions or requests are responded to according to workplace guidelines   3. Simple requests are made in accordance with workplace procedure   4. **Routine procedures** are described in accordance with workplace policy   5. Likes, dislikes and preferences are expressed   6. Different forms of expression in English are identified |
| 1. Participate in workplace meetings and discussions | * 1. Team meetings are attended on time   2. Own opinions are clearly expressed and those of others are listened to without interruption   3. Meeting inputs are consistent with the meeting purpose and established ***protocols***   4. ***Workplace interactions*** are conducted in a courteous manner   5. Questions about simple routine workplace procedures and maters concerning working conditions of employment are asked and responded to   6. Meetings outcomes are interpreted and implemented |
| 1. Complete relevant work-related documents | * 1. Range of forms relating to conditions of employment are completed accurately and legibly   2. Workplace data is recorded on standard workplace forms and documents   3. Basic mathematical processesare used for routine calculations   4. Errors in recording information on forms/ documents are identified and properly acted upon   5. Reporting requirements to supervisor are completed according to organizational guidelines |

**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** |
| Appropriate Sourcesinclude but not limited to: | * Various department heads, * organization documents |
| Medium include but not limited to: | Method of communication   * Physical media * Mechanical media |
| Routine procedures include but not limited to: | * Day to day activities |
| Protocols include but not limited to: | * Procedures for doing a task |
| Workplace interactionsinclude but not limited to: | * Official inter relations |

**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
* Listening
* Attention to detail
* Communication
* Report writing
* Interpretation
* Basic Information Technology (IT)

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Minutes
* Meetings
* Report writing

**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. Prepared written communication following standard format of the organization 2. Accessed information using communication equipment 3. Spoken English at a basic operational level 4. Made use of relevant terms as an aid to transfer information effectively 5. Conveyed information effectively adopting the formal or informal communication |
| 1. Resource Implications | * 1. Telephone   2. Writing materials   3. Internet |
| 1. Methods of Assessment | * 1. Direct Observation   2. Oral interview and written test |
| 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/PS/BC/02/3/A

**UNIT DESCRIPTION**

This unit covers the competencies required to effectively demonstrate digital literacy in a working environment. It entails identifying and using digital devices such as smartphones, tablets, laptops and desktop PCs for purposes of communication and performing work related tasks at the work place.

**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. Identify computer software and hardware | * 1. ***Computer software*** are identified according to manufacturer’s specification   2. ***Appropriate computer hardware*** is identified according to manufacturer’s specification |
| 1. Apply security measures to data, hardware, software | * 1. ***Data security and privacy are classified*** in accordance with the technological situation   2. ***Security 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. Basic ***word processing concepts*** are applied in resolving workplace tasks   2. ***Word processing utilities*** are applied in accordance with workplace procedures   3. Data is manipulated on worksheet in accordance with office procedures |
| 1. Apply internet and email in communication at workplace | * 1. Electronic mail is applied in workplace communication in accordance with office procedures   2. Office internet functions are defined and executed in accordance with office procedures   3. ***Network configuration*** and uses are determined in accordance with office operations 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.

|  |  |
| --- | --- |
| **Range** | **Variable** |
| Computer softwareinclude but not limited to: | * A collection of instructions that enable the user to interact with a *computer*, its hardware, or perform tasks. * Computer tools that will help *computer* users interact with the hardware in a *computer.* |
| Computer hardware may include but not limited to: | Collection of physical parts of a computer system.   * Computer case * Monitor * Keyboard * Mouse and all the parts inside the computer case, such as the hard disk drive, motherboard, video card etc. |
| Data security and privacy include but not limited to: | * Confidentiality * Cloud computing * Confidentiality * Cyber terrorism * Integrity -but-curious data serving |
| Security and control measures may include but not limited to: | * Countermeasures and risk reduction * Cyber threat issues * Risk management |
| 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 calculator
* Basic ICT skills

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Input and output devices
* Central processing Unit (CPU)
* Peripherals
* Storage Media
* Software concept
* Types of concept
* Function of computer software
* Data security and privacy
* Security threats and control measures
* 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 sheet;
* Meaning, formulae, function and charts, uses, layout, data manipulation and application to cell
* Networking and Internet;
* Meaning, functions and uses of networking and internet.
* Electronic mail and world wide web
* Emerging trends and issues in ICT;
* Identify and apply 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 input, output, CPU and storage media devices of computers in accordance to computer specification   2. Identified concepts, types and functions of computer software according to operation manual   3. Identified and controlled security threats   4. Detected and protected computer crimes   5. Applied word processing in office tasks   6. Prepared work sheet and applied data to the cells in accordance to workplace procedures   7. Used Electronic Mail for office communication as per workplace procedure   8. Applied internet and World Wide Web for office tasks in accordance with office procedures   9. Applied laws governing protection of ICT |
| 1. Resource Implications | * 1. Smartphones   2. Tablets   3. Laptops   4. Desktop computers   5. Calculators   6. Internet   7. Operation 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/PS/BC/03/3/A

**UNIT DESCRIPTION**

This unit specifies the competencies required to demonstrate Entrepreneurial skills. It involves developing entrepreneurial culture, identifying entrepreneurial opportunities, starting a small business, operating a small business and growing a small business.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  Bold and italicized terms are elaborated in the Range |
| 1. Develop entrepreneurial culture | 1. **Entrepreneurship terminologies** are defined following established procedures. 2. Contribution of entrepreneurship towards national development is identified in accordance to national development goals 3. Self-employment benefit are identified and emphasized to help create a positive attitude 4. Cultural factors that promote or inhibit entrepreneurial development **are *identified and emphasis made on entrepreneurial promotion*** 5. Ways of managing factors that inhibit development of entrepreneurial culture are identified in accordance withcultural background and national social economic situation |
| 1. Identify entrepreneurial opportunities | * 1. Myths associated with entrepreneurship, types of entrepreneurs and characteristics of entrepreneurship are determined in accordance with the set procedures   2. Identification of ***sources of business ideas*,** generation of business ideas is undertaken in accordance with the existing procedure   3. Evaluation of business opportunities is undertaken according to prevailing office procedures   4. Competencies are matched with business opportunities in accordance with business practices. |
| 1. Start a small business | * 1. Factors to consider when starting a small business are identified according to business sector.   2. ***Forms of business ownership*** are identified and procedure of starting a small business stipulated according to relevant legal requirements   3. Procedure of starting a small business is identified as per the legal requirements   4. Challenges faced when starting a small business are identified and mitigating factors provided for in accordance prevailing legal and regulatory requirement   5. ***Resource requirement*** for a small business are specified according to nature of business   6. ***Business life cycle*** is projected as per the nature of business and national social economic situation |
| 1. Operate a small business | * 1. ***Relevant terms*** are defined in accordance with the set rules   2. Small business record is maintained in accordance with office procedures   3. ***Business support services*** are set up in accordance with the nature and size of business   4. ***Marketing activities*** are effected according to the nature and size of business   5. Small enterprise business plan is prepared depending on the size and nature of business and the client specification   6. Small business resources are run for efficiency and profitability   7. Small business records are kept for decision making purposes   8. Word processing concepts are applied in the management of small business according to office procedures   9. Basic computer application software and emerging trends and concerns are applied in small business management in accordance with office procedures |
| 1. Grow a small business | * 1. Methods of growing/expanding a small business are identified and implemented in accordance with growth schedule   2. Resources for growing small business are identified and implementing   3. Small business growth plans are prepared according to growth schedule   4. ICT and small business growth schedule is prepared in accordance with office procedures   5. Use of computers and technology is incorporated in small scale business growth schedule in accordance with technological trends   6. Social media is used for business growth and profitability   7. Emerging issues and trends are considered in accordance with business growth schedule and activities   8. Community interest is built in product/service according to growth plan   9. Business communication is enhanced according to business ***communication plan*** and profitability   10. Basic business growth strategies are identified and implemented for increased profitability   11. Word processing concepts are applied in growing of small business according to office procedures   12. Basic computer application software, programming and emerging trends and concerns are applied in small business growth in accordance with office procedures for growth and profitability |

**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.

|  |  |  |
| --- | --- | --- |
| Entrepreneurship terminologies include but not limited to: | |  | | --- | | * Entrepreneurship * Enterprise * Business vision. Mission, core values, objectives | |
| Sources of business ideas include but not limited to: | |  | | --- | | * Brainstorming * Personal hobbies * Newspapers, magazines, * Friends and relatives * Accounting/Administrative work * Modern trends and concerns | |
| Forms of business ownership include but not limited to: | * Sole proprietorship * Partnership * Limited Company * Unlimited Company |
| Resource requirement include but not limited to: | * Human * Equipment * Finance |
| Business life cycle include but not limited to: | * Start-up * Growth * Expansion * Decline of a business |
| Relevant terms include but not limited to: | * Seed capital * Business startup |
| Marketing activities include but not limited to: | * Digital marketing * Social media marketing |

**REQUIRED SKILLS AND KNOWLEDGE**

**Required Skills**

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

The individual needs to demonstrate the following skills:

* Individual marketing skills
* Using basic advertising (posters/ tarpaulins, flyers, social media,
* Basic bookkeeping/ accounting skills
* Communication skills

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Public relations concepts
* Basic product promotion strategies
* Basic market and feasibility studies
* Basic business ethics
* Building customer relations
* Business models and strategies
* Types and categories of businesses
* Business internal controls
* Relevant national and local legislation and regulations
* Basic quality control and assurance concepts
* Building relations with customer and employees
* Building competitive advantage of the enterprise

**EVIDENCE GUIDE**

This section describes the required skills which supports performance. These skills will need to be considered in the learning and assessment process.

|  |  |  |
| --- | --- | --- |
| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   |  | | --- | | 1. Demonstrated basic entrepreneurial skills 2. Demonstrated ability to conceptualize and plan a micro/small enterprise 3. Demonstrated ability to manage/operate a micro/small-scale business 4. Demonstrated basic marketing skills | |
| 1. Resource Implications | |  | | --- | | The following resources should be provided: |  * 1. Case problems on micro/small-scale enterprises   2. Materials and location relevant to the proposed activity and tasks |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   |  |  | | --- | --- | | 3.1 Case problems  3.2 Oral Questioning  3.3 Portfolio |  | |
| 1. 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 | |

**DEMONSTRATE EMPLOYABILITY SKILLS**

**UNIT CODE:** ENG/OS/PS/BC/04/3/A

**UNIT DESCRIPTON**

This unit covers competencies required to demonstrate employability skills. It involves conducting self-management, demonstrating critical safe work habits, demonstrating workplace learning 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 handled as per workplace requirements 3. Assertiveness is developed and maintained based on the requirements of the job. 4. Accountability and responsibility for own actions are demonstrated. 5. Self-esteem and a positive self-image are developed and maintained. 6. Time management, attendance and punctuality are observed as per the organization policy. 7. Interpersonal communication demonstrated 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. ***Feedback*** on performance is collected based on established ***team*** learning process   4. Abstinence from ***drug and substance abuse*** is observed as per workplace policy.   5. Awareness of HIV and AIDS is demonstrated in line with workplace requirements.   6. Safety consciousness is demonstrated in the workplace based on organization safety policy.   7. ***Emerging issues*** are dealt with in accordance with organization policy. |
| 1. Demonstrate workplace learning | * 1. Personal training needs are identified in line with the requirements of the job   2. Learning opportunities are identified based on job requirement and in line with organization policy.   3. Contribution to the learning community at the workplace is carried out.   4. Application of learning is demonstrated in both technical and non-technical aspects based on requirements of the job   5. Enthusiasm for ongoing learning is demonstrated   6. Willingness to learn in different context is demonstrated based on available learning opportunities arising in the workplace.   7. Awareness of personal role in workplace ***innovation*** is demonstrated. |
| 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. 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 |
| Team includes but not limited to: | * Small work group * Staff in a section/department * Inter-agency group |
| 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 |

**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 critical safe work habits   3. Demonstrated workplace learning   4. 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:   * 1. Oral Interview   2. Observation   3. Third Party Reports   4. 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/PS/BC/05/3/A

**UNIT DESCRIPTION**

This unit specifies the competencies required to follow procedures for environmental hazard control, follow procedures for environmental pollution control and comply with workplace sustainable resource use.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms*** ***are elaborated in the Range*** |
| 1. Control environmental hazard | 1. ***Storage and handling 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 | * 1. ***Environmental pollution******control measures*** are complied with 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, Recycle)   3. Methods for economizing or reducing ***resource*** consumption are practiced. |

**RANGE**

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

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. PPE may include but are not limited to: | 1.1 Mask  1.2 Gloves  1.3 Goggles  1.4 Safety hat  1.5 Overall  1.6 Hearing protector |
| 1. Environmental pollution control measures may include but are not limited to: | * 1. Methods for minimizing or stopping spread and ingestion of airborne particles   2. Methods for minimizing or stopping spread and ingestion of gases and fumes   3. Methods for minimizing or stopping spread and ingestion of liquid wastes |
| 1. Waste management procedures may include but are not limited to: | 3.1 Sorting  3.2 Storing of items  3.2 Recycling of items  3.3 Disposal of items |
| 1. Resources may include but are not limited to: | 4.1 Electric  4.2 Water  4.3 Fuel  4.3 Telecommunications   * 1. Supplies   4.5 Materials |
| 1. Workplace environmental hazards may include but are not limited to: | 5.1Biological hazards  5.2 Chemical and dust hazards  5.3 Physical hazards |

**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

**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
* Solid Waste Act
* Methods of minimizing wastage
* Waste management procedures
* Economizing of resource consumption
* Principle of 3Rs

**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 Controlled environmental hazard  1.2 Controlled environmental pollution  1.3 Demonstrated sustainable resource use |
| 1. Resource Implications | The following resources should be provided:   * 1. Workplace with storage facilities   2. Tools, materials and equipment relevant to the tasks (ex. Cleaning tools, cleaning materials, trash bags, etc.)   3. PPE   4. Manuals and references |
| 1. Methods of Assessment | Competency in this unit may be assessed through:  3.1 Demonstration  3.2 Oral questioning  3.3 Written examination |
| 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/PS/BC/06/3/A

**UNIT DESCRIPTION**

This unit specifies the competencies required to practice and promote safety and health at work.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms*** ***are elaborated in the Range*** |
| 1. Prepare to practice safety and health at work | 1.1 Awareness of legislation that outlines the minimum standards for occupational safety and health requirements/ regulations are emphasized  1.2 Benefits of implementing an occupational safety and health program are identified  1.3 ***Safety requirements/ regulations*** of own work and of other workers are familiarized  1.4 Workplace standards and procedures for incidents and Emergencies are determined  1.5 ***Prevention and control measures***, including use of ***safety gears/PPE*** (Personal Protective Equipment) to avoid accident, injuries and sickness are identified |
| 1. Comply and promote compliance of workers to organization’s occupational safety and health instructions and requirements | 2.1 Safety instructions and safety signs are followed and disseminated to co-workers  2.2 Safe handling of tools, equipment and materials is learned and shared with co-workers  2.3 Execution of own work and of co-workers is monitored in  according to safe work procedures  2.4 Use of safe guards and safety devices is monitored  2.5 Hazards, incidents, injuries and sickness in the workplace are reported properly following standards and 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** |
| 1. Safety requirements / regulations may include but are not limited to: | 1.1 Building code  1.2 Permit to Operate  1.3 Occupational Safety and Health Standards |
| 1. Incidents and emergencies may include but are not limited to: | 2.1 Chemical spills  2.2 Equipment/vehicle accidents  2.3 Explosion  2.4 Fire  2.5 Gas leak  2.6 Injury to personnel  2.7 Structural collapse   * 1. Toxic and/or flammable vapors emission. |
| 1. Prevention and control measures may include but are not limited to: | 3.1 Eliminate the hazard (i.e., get rid of the dangerous machine  3.2 Isolate the hazard (i.e. keep the machine in a closed room and operate it remotely; barricade an unsafe area off)  3.3 Substitute the hazard with a safer alternative (i.e., replace the machine with a safer one)  3.4 Use administrative controls to reduce the risk (i.e. give trainings on how to use equipment safely; OSH-related topics, issue warning signages, rotation/shifting work schedule)  3.5 Use engineering controls to reduce the risk (i.e. use safety guards to machine)  3.6 Use personal protective equipment  3.7 Safety, Health and Work Environment Evaluation   * 1. Periodic and/or special medical examinations of workers |
| 1. Safety devices/ PPEs (personal protective equipment) May include but are not limited to: | 5.1 Arm/Hand guard, gloves  5.2 Eye protection (goggles, shield)  5.3 Hearing protection (ear muffs, ear plugs)  5.4 Hair Net/cap/bonnet  5.5 Hard hat  5.6 Face protection (mask, shield)  5.7 Apron/Gown/coverall/jump suit  5.8 Anti-static suits  5.9 High-visibility reflective vest |

**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:

* Communication skills
* Knowledge management
* Interpersonal skills
* Troubleshooting skills
* Critical thinking skills
* Observation skills
* Monitoring skills
* Reporting skills

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Elements of an effective occupational safety and health program
* Benefits of implementing an occupational safety and health program
* Safety requirements of own work and of other workers
* Standard emergency plan and procedures in the workplace
* Different OSH control measures
* General OSH principles
* Work standards and procedures
* Safe handling procedures of tools, equipment’s and materials
* Standard emergency plan and procedures in the workplace
* Different OSH control measures
* Standard accident and illness reporting procedures in the workplace
* Monitoring system on compliance to work safety and health

**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. Emphasizes awareness of OSH legislations   2. Identifies benefits of implementing OSH program   3. Identifies safety requirements of own work and of co-workers   4. Identifies and shares with co-workers OSH control measures and emergency plan in the workplace   5. Identifies and shares with co-workers the ***control measures*** to prevent accident, injuries andsickness   6. Follows and disseminate to co-workers the safety instructions and safety signs at work   7. Learns and shares with co-workers the learnings on safe handling of tools, equipment and materials   8. Monitors safe execution of own work and of co-workers   9. Monitors compliance to safety measures   10. Reports hazards, incidents, injuries and sickness following workplace procedures |
| 1. Resource Implications | The following resources should be provided:  2.1 Facilities, materials tools and equipment necessary for the activity |
| 1. Methods of Assessment | Competency in this unit may be assessed through:  3.1 Observation/Demonstration with oral questioning  3.2 Third party report |
| 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

**APPLY MATHEMATICS**

**UNIT CODE:** ENG/OS/PS/CC/01/3/A

**UNIT DESCRIPTION**

This unit describes the competencies required by a worker in order to apply a wide range of mathematical calculations for work; apply ratios, rates and proportions to solve problems; estimate, measure and calculate measurement for work; Use detailed maps to plan travel routes for work; Use geometry to draw and construct 2D and 3D shapes for work; Collect, organize and interpret statistical data; Use routine formula and algebraic expressions for work and use common functions of a scientific calculator

**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 a wide range of mathematical calculations for work | 1. Mathematical information embedded in a range of workplace tasks and texts is extracted 2. Mathematical information is interpreted and comprehended 3. A range of mathematical and problem-solving processes are select and used 4. Different forms of fractions, decimals and percentages are flexibly used 5. Calculation performed with positive and negative numbers 6. Numbers are expressed as powers and roots and are used in calculations 7. Calculations done using routine formulas 8. Estimation and assessment processes are used to check outcome 9. Mathematical language is used to discuss and explain the processes, results and implications of the task |
| 2. Use and apply ratios, rates and proportions for work | * 1. Information regarding ratios, rates and proportions extracted from a range of workplace tasks and texts   2. Mathematical information related to ratios, rate and proportions is analyzed   3. Problem solving processes are used to undertake the task   4. Equivalent ratios and rates are simplified   5. Quantities are calculated using ratios, rates and proportions   6. Graphs, charts or tables are constructed to represent ratios, rates and proportions   7. The outcomes reviewed and checked   8. Information is record using mathematical language and symbols |
| 3. Estimate, measure and calculate measurement for work | 1. Measurement information embedded in workplace texts and tasks are extracted and interpreted 2. Appropriate workplace measuring equipment are identified and selected 3. Accurate measurements are estimate and made 4. The area of 2D shapes including compound shapes are calculated 5. The volume of 3D shapes is calculated using relevant formulas 6. Sides of right-angle triangles are calculated using Pythagoras’ theorem 7. conversions are performed between units of measurement 8. Problem solving processes are used to undertake the task 9. The measurement outcomes are reviewed and checked 10. Information is recorded using mathematical language and symbols appropriate for the task |
| 4. Use detailed maps to plan travel routes for work | * 1. Different types of maps are identified and interpreted   2. Key features of maps are identified   3. Scales are identified and interpreted   4. Scales are applied to calculate actual distances   5. Positions or locations are determined using directional information   6. Routes are planned by determining directions and calculating distances, speeds and times   7. Information is gathered and identified, and relevant factors related to planning a route checked   8. Relevant equipment is select and checked for accuracy and operational effectiveness   9. Task is planned and recorded using specialized mathematical language and symbols appropriate for the task |
| 5. Use geometry to draw 2D shapes and construct 3D shapes for work | 1. A range of 2D shapes and 3D shapes and their uses in work contexts is identified 2. Features of 2D and 3D shapes are named and described 3. Types of angles in 2D and 3D shapes are identified 4. Angles are drawn, estimated and measured using geometric instruments 5. Angle properties of 2D shapes are named and identified 6. Angle properties are used to evaluate unknown angles in shapes 7. Properties of perpendicular and parallel lines are applied to shapes 8. Understanding and use of symmetry is demonstrated 9. Understanding and use of similarity is demonstrated 10. The workplace tasks and mathematical processes required are identified 11. 2D shapes is drawn for work 12. 3D shapes is constructed for work 13. The outcomes are reviewed and checked 14. Specialized mathematical language and symbols appropriate for the task are used |
| 6. Collect, organize, and interpret statistical data for work | 1. Workplace issue requiring investigation are identified 2. Audience / population / sample unit is determined 3. Data to be collected is identified 4. Data collection method is selected 5. Appropriate statistical data is collected and organized 6. Data is illustrated in appropriate formats 7. The effectiveness of different types of graphs are compared 8. The summary statistics for collected data is calculated 9. The results / findings are interpreted 10. Data is checked to ensure that it meets the expected results and content 11. Information from the results including tables, graphs and summary statistics is extracted and interpreted 12. Mathematical language and symbols are used to report results of investigation |
| 7. Use routine formula and algebraic expressions for work | 1. Understanding of informal and symbolic notation, representation and conventions of algebraic expressions is demonstrated 2. Simple algebraic expressions and equations are developed 3. Operate on algebraic expressions 4. Algebraic expressions are simplified 5. Substitution into simple routine equations is done 6. Routine formulas used for work tasks are identified and comprehended 7. Routine formulas are evaluated by substitution 8. Routine formulas transposed 9. Appropriate formulas are identified and used for work related tasks 10. Outcomes are checked and result of calculation used |
| 8. Use common functions of a scientific calculator for work | 1. Required numerical information to perform tasks is located 2. The order of operations and function keys necessary to solve mathematical calculation are determined 3. Function keys on a scientific calculator are identified and used 4. Estimations are referred to check reasonableness of problem-solving process 5. Appropriate mathematical language, symbols and conventions are used to report results |

**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** |
| Geometry includes but not limited to: | * Scale drawing * Triangles * Simple solid * Round * Square * Rectangular * Triangle * Sphere * Cylinder * Cube * Polygons * Cuboids |

**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 calculator
* Using different measuring tools

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Types of common shapes
* Differentiation between two dimensional shapes / objects
* Formulae for calculating area and volume
* Types and purpose of measuring instruments
* Units of measurement and abbreviations
* Fundamental operations (addition, subtraction, division, multiplication)
* Rounding techniques
* Types of fractions
* Different types of tables and graphs
* Meaning of graphs, such as increasing, decreasing, and constant value
* Preparation of basic data, tables

**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. Performed calculation using positive and negative numbers   2. Numbers expressed as powers and roots were used in calculations   3. Calculated quantities using ratios, rates and proportions   4. Constructed graphs, charts and tables were represented in forms of ratios, rates and proportions   5. Calculated the volumes of 3D shapes using relevant formulas   6. Calculated sides of right-angle triangles using Pythagoras’ theorem   7. Performed conversions between units of measurement   8. Used problem solving processes to undertake the task   9. Determined positions or locations using directional information   10. Simplified algebraic expressions   11. Used appropriate mathematical language, symbols and conventions in reporting results |
| 2. Resource Implications | The following resources should be provided:   1. Materials relevant to the proposed task |
| 3. Methods of Assessment | 3.1 Case problems  3.3 Portfolio  3.4 Third part reports |
| 4. 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 |
| 5. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# 

**PERFORM WORKSHOP PROCESS AND MATERIAL**

**UNIT CODE:** ENG/OS/PS/CC/02/3/A

**UNIT DESCRIPTION**

This unit describes the competencies required to perform workshop. Competencies include; planning work operations, selecting tools and materials, measuring and marking out dimensions on work piece, cutting and filing parts, drilling holes, producing threads, producing components using lathe machine, assembling metal parts and sub-assemblies, polishing finished work, performing housekeeping, inspecting accuracy and quality of finished work and maintaining tools and equipment.

**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. Plan work operations | * 1. Technical drawings and geometric symbols are read and interpreted as per ***drawing standards.***   2. ***Operation Plan*** is produced as per the technical drawings.   3. Technical drawings are produced ***as*** per drawing Standards. |
| 1. Select tools and materials | * 1. Working tools, equipment and materials are selected for the task.   2. The work areas are tidied up as per organization policy. |
| 1. Measure and mark out dimensions on work pieces | * 1. Measuring tools suitable for the work are selected   2. Measuring tools are inspected and calibrated if required   3. Dimensions are marked on the workpiece as per the working drawing. |
| 1. Producing components as per the drawing | * 1. Hand and Machine tools are operated in adherence of workshop safety practices   2. ***Hand and Machine tools*** are selected based on operation plan   3. Part are produced to ***specifications*** as per the drawings   4. ***Holes are drilled*** to specification as per the drawings   5. ***Threads are*** cut to specification as per the drawings   6. Work pieces are turned to specification in Lathe machine   7. Parts ***joined***, fitted and assembled   8. Finished work is cleaned and ***polished*** |
| 1. Perform housekeeping | * 1. Waste is segregated and disposed as per disposal guidelines.   2. Housekeeping is carried out as per workplace requirement |
| 1. Maintain tools and equipment | * 1. Machines and tools are inspected as per the workshop rules   2. Machines and tools are lubricated in line to their operation standards   3. Tools are ground to specification according to engineering best practice   4. Faults on machines and tools are identified and reported   5. Tools and equipment are stored as per the workshop rules and practices |

**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** |
| --- | --- |
| Measuring tools include but not limited to: | * + Steel rule   + Vernier caliper   + Micrometer screw gauge   + Vernier height gauge   + Combination set   + Bevels |
| Drawing Standards include but not limited to: | * + ISO   + BS   + ANSI |
| Operation Plan include but not limited to: | * + Sequence of operations   + Measuring tools   + Hand tools   + Cutting tools   + Inspection tools |
| Marking out tools include but not limited to: | * + Scribers   + Dividers   + Dot punch   + Centre punch   + Engineers square   + Straight edge   + Surface plate |
| Work holding devices include but not limited to: | * + Bench vice   + V-Block   + Angle plate   + G-clamp   + Jigs and fixtures   + Hand vice |
| Hand tools include but not limited to: | * + Files   + Saws   + Hammers   + Chisels   + Taps and dies |
| Workshop machines include but not limited to: | * + Drilling machines   + Lathe machine   + Grinding machine   + Shaper   + Milling machine |
| Threads include but not limited to: | * + Internal and external threads   + V-profile threads   + Box profile |
| Polishing include but not limited to: | * + Emery cloth   + Polishing and burnishing machine   + Filing |
| Hole drilled include but not limited to: | * + Location   + Counter sinking   + Counter boring   + Reaming   + Boring |
| Joining include but not limited to: | * + Riveting   + Fastening   + Soldering   + Brazing   + Welding |
| Specifications include but not limited to: | * + Dimensions   + Tolerances   + Geometry   + Surface finish   + Functionality |

**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:

* Technical drawing
* Using measuring and inspection tools
* Using hand tools
* Using portable and bench drilling machines
* Soldering and brazing
* Riveting and fastening
* Basic use of the lathe machine
* Using grinding machine

**Required Knowledge**

The individual needs to demonstrate knowledge and understanding of:

* Occupational Health and Safety Act of Kenya laws 2007 with focus on personal safety, machine safety and workplace
* National Environment Management Authority Act, Kenya 2004
* OSH act
* Equipment manuals
* Basic technical drawing complyingto ISO, ANSI & BS standards
* ISO 1101 Geometrical tolerance and where to use the norm
* Work Planning and documentation
* Measuring tools
* Hand tools
* Bench work
* Portable and bench drilling machines
* Lathe machine
* Grinding machine
* Inspection and quality control
* Preventive maintenance of machine tools
* Metal cutting technology
* Materials and metallurgy
* WIBA act (2007)
* Report writing

EVIDENCE GUIDE

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the learner:   * 1. Observed rules and procedures in the workshop   2. Interpreted technical drawing   3. Produced operation plan   4. Produced holes on a work piece   5. Threaded using taps and dies   6. Assembled metal parts   7. Polished finished work   8. Maintained tools and equipment   9. Did housekeeping before, during and after operations |
| 1. Resource Implications | * 1. Hand measuring tools   2. Hand marking tools   3. Hand tools   4. Inspection tools and equipment   5. Hand drilling machine   6. Bench Drilling machine   7. Lathe machine   8. Milling machine   9. Shapers   10. Grinding machine   11. Work benches   12. Bench vices   13. ISO, BS and ANSI standards   14. Rules and procedures   15. Resource materials, manuals for bench, tools and equipment   16. Materials   17. Cutting tools |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Observing the behaviour of the learner   2. Oral presentations   3. Inspection of written operation procedures   4. Inspection of finished product   5. Observing housekeeping of the work area and/or machine tool |
| 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 MECHANICAL SCIENCE PRINCIPLES**

**UNIT CODE:** ENG/OS/PS/CC/03/3/A

**UNIT DESCRIPTION**

This unit describes the competencies required by a plant and services artisan person to apply the knowledge of mechanical science 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. Use the concept of mechanical science | * 1. Work, force, mechanical advantage velocity ratio and efficiency are described   2. Newton’s laws of motion are described   3. Parameters of linear motion are described   4. Calculations involving work, energy and power are performed |
| 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. Demonstrate understanding of friction | * 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. Determine parameters of a fluid system | * 1. Terms associated with fluid are identified   2. Pascal’s principle is described   3. Fluid parameters are established   4. Gas laws are identified   5. Fluid properties are described   6. Measurement of fluid parameters are described and determined |
| 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. Use of basic mechanical systems in power transfer | * 1. Demonstration of the working principles of gear train is performed   2. Working principles of pulley system, hoists and lifts is demonstrated.   3. Working principles of screws is 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** |
| Forces theorems includes but not limited to: | * + Parallelogram   + Triangle   + Polygon |
| Problems on simple machines includes but not limited to: | * + Machine advantage   + Velocity ratio   + Efficiency |
| Gas laws includes but not limited to: | * + Boyles law   + Charles law   + Ideal Gas equation |
| Density terminology includes but not limited to: | * + Density   + Relative density |
| Pressure applications includes but not limited to: | * + Vacuum pump   + Hydraulic pump   + Hydrometers |
| Principles includes but not limited to: | * + Newton’s laws of motion   + Law of conservation of linear momentum   + Law of conservation of energy   + Archimedes’ principle |
| Mechanical calculations include but not limited to: | * + Mechanical advantage   + Velocity ratios   + Efficiency   + Torque   + Power/Energy   + Work done |
| Laws of fluids includes 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
* Calculation of fluid pressure and flow rate
* Mechanical advantage, velocity ratio 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, 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:   * + Direct Observation   + Demonstration with Oral Questioning   + Case studies   + Written tests |
| 1. 4. Context of Assessment | Competency may be assessed individually in the actual workplace or  through accredited institution |
| 1. 5. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Newton’s laws of motion
* Levers
* Gear trains
* Principle of conservation of linear momentum
* Principle of conservation of energy
* Laws of friction
* Type of forces
* 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 Principlesof 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. 4. Context of Assessment | Competency may be assessed individually in the actual workplace or  through accredited institution |
| 1. 5. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

**APPLY MATERIAL SCIENCE AND METALLURGICAL PROCESSES**

**UNIT CODE:** ENG/OS/PS/CC/04/3/A

**UNIT DESCRIPTION:**

This unit covers the competency required to apply material science and metallurgical processes. Competencies include: analyzing properties of engineering materials, performing ore extraction processes, producing materials, performing heat treatment and preventing material corrosion

**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. Analyze properties of engineering materials | * 1. Type of engineering materials is identified as per the procedures   2. ***Physical properties*** of engineering material are determined   3. ***Mechanical properties*** of engineering materials are tested   4. Crystal structure of materials are analyzed |
| 1. Perform ore extraction processes | 1. Safety procedures are observed according OSHA 2. Method of extraction is determined as per material properties and its composition 3. Procedure in extraction process is determined as per extraction method 4. Extraction by- products are stored as per SOPs 5. Extraction by- products are disposed as per SOPs |
| 1. Produce materials | 1. Methods of producing materials are identified according to the type and application of the materials 2. Iron materials are produced and tested according to the standard operating procedure 3. Alloy materials are produced and tested according to the standard operating procedures 4. Non-ferrous materials are produced and tested according to the standard operating procedures 5. Ceramic materials are produced and tested according to the standard operating procedures 6. composite materials are produced and tested according to the standard operating procedure 7. ***Finishing and*** Refinement processes are identified based on material required. |
| 1. Perform heat treatment | * 1. Safety practices are observed according to OSHA 2007   2. **Heat treatment processes** are identified   3. Procedures in heat treatment processes are established   4. Heat treatment of metals are performed |
| 1. Prevent material corrosion | * 1. Safety is observed during corrosion prevention   2. ***Types of corrosion*** are identified   3. Agents of corrosion are identified   4. ***Methods of corrosion prevention*** are identified   5. Corrosion is prevented |

**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** |
| --- | --- |
| Physical properties includes but not limited to: | * Density * Color * Texture * Melting point * Thermo conductivity * Electrical resistivity |
| Mechanical properties includes but not limited: | * Ductility * Malleability * Elasticity * Toughness * Hardness * Brittleness * Plasticity * Strength |
| Composition of iron includes but not limited to: | * Iron (II) oxide * Iron (III) oxide |
| Iron materials includes but not limited to: | * + Cast iron   + Steel |
| Non-ferrous materials includes but not limited to: | * + Aluminium   + Copper |
| Ceramic materials but not limited to: | * + oxides   + nitrides   + carbides   + silica |
| Finishing processes includes but not limited to: | * + Lapping   + Fine grinding   + Polishing |
| Heat treatment processes includes but not limited to: | * + Annealing   + Tempering   + Normalizing   + Hardening   + Case hardening |
| other engineering materials includes but not limited to: | * + Rubber   + Plastics   + Wood   + Glass |
| Corrosion type | * + Galvanic   + Stress corrosion cracking |
| Methods of corrosion prevention includes but not limited to: | * + Painting   + Electroplating   + Galvinizing   + Cathodic   + Chromizing |

**REQUIRED KNOWLEDGE AND SKILLS**

The individual needs to demonstrate the following skills

**Required Skills**

* Measuring and marking
* Material testing
* Use of hand tools
* Inspection and testing

**REQUIRED KNOWLEDGE AND UNDERSTANDING**

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

* Occupational Health and Safety Act of Kenya laws 2007 with focus on personal safety, machine safety and workplace
* National Environment Management Authority Act, Kenya 2004
* OSH ACT 2007
* Equipment manuals
* Mathematics & science
* Physics and mechanics
* Metallurgy and materials
* Inspection and testing
* WIBA ACT
* Report writing

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the learner   * 1. Observed safety as per work place procedures   2. Demonstrated understanding of physical, chemical and mechanical properties of materials   3. Performed extraction processes   4. Produced various types of materials   5. Performed heat treatment   6. Performed material testing   7. Demonstrated understanding of various agents of corrosion and the corrosion prevention |
| 1. Resource Implications | * 1. Testing materials   2. Extraction materials   3. Measuring instruments   4. Inspection tools |
| 1. Methods of Assessment | Competency may be accessed through:   * 1. Oral questioning   2. Written test   3. Practical 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 of other units relevant to the industry sector, workplace and job role is recommended. |

**APPLY ELECTRICAL PRINCIPLES**

**UNIT CODE:** ENG/OS/PS/CC/05/3/A

**UNIT DESCRIPTION**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range.*** |
| --- | --- |
| * + 1. Use the concept of basic Electrical quantities | * 1. Basic ***SI unit***s in Electrical are identified   2. ***Quantitie***s of Charge, force, work and power are identified   3. Perform calculations involving Ohm’s law i.e Current, Resistance and voltage   4. Calculations involving various electrical quantities are performed   5. Electrical quantities measuring instruments are identified |
| * + 1. Use the concepts of D.C and A.C circuits in electrical installation | * 1. Calculations involving parallel and series circuits are performed   2. Calculations involving Network theorems are performed. E.g. Kirchhoff’s laws and the principle of Superposition.   3. Photovoltaic solar system is identified |
| 1. Use of basic electrical machine | * 1. Types of various electrical machines are identified   2. Operations involving single phase and three phase AC and DC Motors are performed   3. Calculations involving single and three phase AC and DC transformers are performed   4. Operations involving single and three phase generators are performed   5. AC and DC machines are applied as per their functions |
| 1. Use of earthing in Electrical installations | * 1. Earthing types are identified   2. Earthing points on Electrical installation are identified   3. Calculation involved in determining the earthing type is performed   4. Test on an earthing system is performed in line with the IEE regulations |
| 1. Apply lightning protection measures | * 1. Types of lightning strokes are identified   2. Components of lightning protection system are identified   3. Test to be carried out in lightning protection system are established   4. Application of lightning protection system is determined |

**RANGE**

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

|  |  |
| --- | --- |
| **Variable** | **Range** |
| SI unit includes but not limited to: | * 1. Power – Watts (W)   2. Current – Amperes (A)   3. Resistance – Ohms(Ω)   4. Voltage – Volts (V) |
| Quantities includes but not limited to: | * 1. Charge   2. Force   3. Work   4. Power |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skills:

* Apply basic Electrical formulas
* Use of basic Electrical instruments
* Perform various unit conversions of Electrical quantities
* Electrical earthing
* Lightening arrestors
* Power factor correction
* logical thinking
* problem solving
* applying statistics
* drawing graphs
* Using different measuring tools

**Required knowledge**

The individual needs to demonstrate knowledge of:

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

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   * 1. Applied the correct SI units of Electrical quantities   2. Stated, calculate and relates the quantities in Ohm’s law   3. Identified the components of an earthing system   4. Stated and apply various laws in Electrical system   5. Differentiated between AC and DC network   6. Applied correct formulas in the calculation of AC and DC machines   7. Identified types of lightning arrestors and their applications |
| 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. 4. Context of Assessment | Competency may be assessed individually in the actual workplace or  through accredited institution |
| 1. 5. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

**PREPARE AND INTERPRET TECHNICAL DRAWINGS**

**UNIT CODE:** ENG/OS/PS/CC/06/3/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 and application of Computer Aided Design (CAD) packages.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***(Bold and italicised terms are elaborated in the Range)*** |
| --- | --- |
| 1. Use and maintain drawing equipment and materials | 1.1 ***Drawing equipment*** are identified and gathered according to task requirements  1.2 ***Drawing materials*** are identified and gathered according to task requirements  1.3 Drawing equipment are used and maintained as per manufacturer’s instructions  1.4 Drawing materials are used as per workplace procedures  1.5 Waste materials are disposed in accordance with workplace procedures and ***environmental legislations***  1.6 ***Personal Protective Equipment*** is used according to occupational safety and health regulations |
| * 1. Produce plane 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 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 conventions   6. Freehand sketching of different types of geometric forms, tools, equipment, diagrams is conducted |
| * 1. Produce solid geometry drawings | * 1. Drawings of patterns are interpreted according to standard conventions   2. Patterns are developed in accordance with standard conventions |
| * 1. Produce orthographic and pictorial drawings | * 1. Symbols and abbreviations are identified and their meaning interpreted according to standard drawing conventions   2. First and third angle orthographic drawings are interpreted and produced in accordance with the standard conventions   3. Orthographic elevations are dimensioned in accordance with standard conventions   4. Isometric drawings are interpreted and produced in accordance with standard conventions |
| 5. Produce mechanical drawings | * 1. Mechanical symbols and abbreviations are identified and their meaning interpreted according to BS 3939   2. ***Mechanical drawings*** are produced in accordance with BS 3939 |
| 6. Apply CAD packages | * 1. CAD packages are selected according to task requirements   2. CAD packages are applied in production of electrical drawings |

**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 includes but not limited to: | Drawing boards, T and set squares, drawing sets, computers with CAD packages |
| Drawing materials includes but not limited to: | Drawing papers, pencils, erasers, masking tapes, paper clips |
| Environmental legislations includes but not limited to: | EMCA 1999 |
| Personal Protective Equipment includes but not limited to: | Dust coats, closed leather shoes |
| Geometric forms includes but not limited to: | Circles, triangles, rectangles, parallelogram, polygons, pyramids, conic sections, prisms, loci |
| Standard conventions includes 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 |
| Mechanical drawings includes but not limited to: | Block, schematic and line diagrams |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required skills**

The individual needs to demonstrate the following skills:

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

**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 drawings, assembly and lay out 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 |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Practical tests   2. Observation |
| 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. |

# CORE COMPETENCIES

# PERFORM GENERAL OPERATION AND MAINTENANCE OF PLANT MACHINERY

**UNIT CODE:** ENG/OS/PS/CR/01/3/A

**UNIT DESCRIPTION**

This unit covers the competencies required to perform general operation and maintenance of the plant machinery. Competencies include; operating plant machinery, maintaining plant machinery and test running of the plant machinery.

**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 italicised terms are elaborated in the Range)*** |
| --- | --- |
| 1. Operate plant machinery | 1. Safety measures, rules and regulations to be adhered to in plant operations. 2. Preparation of plant machinery to be operated as per workplace procedures Tools and equipment for operation to be used correctly. 3. Pre-operational checks 4. Switch **ON** power source 5. Operation is conducted according to laid out procedures. 6. Switch **OFF** power source. 7. Post-operational checks as per machine |
| 1. Maintain Plant Machinery | * 1. Safety measures, rules and regulations to be adhered to in plant maintenance.   2. Tools and equipment for maintenance to be used correctly.   3. Conduction of **CUT OUT/ LOCK OUT** of plant machinery   4. Preparation of plant machinery to be maintained as per workplace procedures.   5. Maintenance to be carried out as per laid out procedures |
| 1. Test run the plant machinery | * 1. Observation Safety measures, rules and regulations on test running to be adhered to.   2. Preparation for test running as per laid out procedures.   3. Tools and equipment for test running to be assembled and used correctly.   4. Test running to be carried out as per laid out procedures. |

**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** |
| --- | --- |
| Original equipment manufacturer includes but not limited to: | 1. Kiloskar 2. Davis and Shirtliff |
| Operation limit includes but not limited to: | * 1. Speed   2. Output parameters |
| international standards includes but not limited to: | * 1. ISO 5199   3.2 ANSI B73.1   * 1. ISO 2858 |

**REQUIRED KNOWLEDGE AND UNDERSTANDING**

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

|  |
| --- |
| * Fabrication * Basic knowledge on plumbing * Drawing * Workshop tools and material * Management of different wastes * Workmanship * Maintenance |

**FOUNDATION SKILLS**

|  |
| --- |
| The individual needs to demonstrate the following foundation skills: |
| * Selection of maintenance tools and equipment * Lubricants * PPE at different work stations * Practicing safety practices * Waste segregation and management |

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Performed operation as per the laid out procedures   2. Performed maintenance within the acceptable standards   3. Performed testing in accordance with expected operations |
| 1. Resource Implications | Resources the same as that of workplace are advised to be applied including   * 1. Workshops   2. Plant machinery   3. Toolboxes   4. Tools, equipment & materials   5. PPE |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Observation   2. Oral questioning   3. Practical tests   4. Written tests |
| 1. Context of Assessment | Competency may be assessed individually   * 1. In the actual workplace   2. Simulated environment of the work place |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# PERFORM GENERAL MAINTENANCE OF REFRIGERATION AND AIR CONDITIONING SYSTEMS

**UNIT CODE:** ENG/OS/PS/CR/02/3/A

**UNIT DESCRIPTION**

This unit covers the competencies required to safely maintain refrigeration and air conditioning systems. Competencies includes; assembling refrigeration and air conditioning tools, equipment and materials, conducting basic electrical wiring for refrigeration and air conditioning system, servicing refrigeration and air conditioning system, test running serviced refrigeration and air conditioning systems.

**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. Service refrigeration and air conditioning systems | * 1. Tools equipment and materials are assembled according to workplace procedures   2. Refrigeration and air conditioning units are serviced according to work place procedures   3. Brackets, hangers and frames are serviced in accordance workplace procedures   4. ***Sealing materials*** are applied as per system conditions.   5. ***Condensate drains*** are serviced in accordance to laid out procedures.   6. Safe manual handling techniques are employed in line with work place ***OS&H procedures***   7. Checks are carried out on the serviced systems |
| 1. Test Run serviced refrigeration and air conditioning system | * 1. System is tested as per work place procedures   2. System adjustments are conducted as per test run observations. |

**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 includes but not limited to: | * + Screw drivers   + Chisel   + Hammers (claw and ballpein)   + Hacksaws   + Files   + Grinders   + Electric drills   + Drill bits   + Cross cut saws   + Arc welding equipment   + Brazing equipment   + Lokring tools   + Refrigerant cylinders |
| Materials includes but not limited to: | * + Welding electrode (rod)   + Sealant   + Refrigerants |
| Sealing materials includes but not limited to: | * + Rubber gasket   + Arm flex   + Foam   + Plastic   + Silicone |
| Condensate drain includes but not limited to: | * + PVC pipe   + Plastic tubing   + Galvanized (G.I) pipe   + Metal tubing |
| OS&H procedures includes but not limited to: | * + Wearing of PPE   + Lifting procedures   + Ladder safety   + Housekeeping |

**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:

* Preparing materials
* Proper handling of tools and equipment
* Working safely
* Operating window-type and split-type air-conditioning unit and domestic refrigeration unit

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Personal protective equipment/safety gears
* Handling of tools, equipment and accessories
* Safety signs and symbols
* Good housekeeping
* Linear measurements
* Unit conversion
* Types of sealant
* Types of insulation
* Refrigeration and air conditioning components
* Basic arc welding
* Preventive Maintenance
* Basic information record keeping
* Basic data analysis and presentation
* Basic digital Literacy

**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. Adhered to safety procedures   2. Identified tools, equipment and materials   3. Serviced refrigeration system   4. Performed housekeeping |
| 1. Resource implications | The following resources must be provided:  2.1Tools and equipment appropriate for servicing  2.2 Materials for servicing |
| 1. Methods of assessment | Competency may be assessed through:   * 1. Demonstration   2. Direct observation with oral questioning   3. Written tests |
| 1. Context for 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. |

# PERFORM GENERAL PLANT MAINTENANCE

**UNIT CODE:** ENG/OS/PS/CR/03/3/A

**UNIT DESCRIPTION**

This unit covers the competencies required to perform general plant maintenance. Competencies includes: assembling maintenance tools, equipment and materials, decommissioning of plant equipment to be maintained, carrying out maintenance and test running maintained equipment.

**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 italicised terms are elaborated in the Range)*** |
| --- | --- |
| 1. Assemble maintenance tools, equipment and materials. | * 1. Workshop safety is adhered to in tools, materials and equipment handling   2. Maintenance tools, equipment and materials and are assembled as per maintenance to be carried out   3. Tools, equipment and materials are set as per maintenance to be carried out |
| 1. Decommission plant equipment to be maintained | * 1. Safety rules and regulations are adhered to in the equipment decommissioning.   2. Decommissioning is performed as per laid out procedures |
| 1. Carry out maintenance | * 1. Safety rules and regulations are adhered to in maintenance activities   2. Basic fault diagnosis carried out.   3. Maintenance is carried out as per the nature of the tasks to be performed   4. Repair/replacement of the faulty components as per laid out procedures   5. Waste disposal is performance in accordance to as per workplace standards |
| 1. Test Run | * 1. Safety rules and regulations are adhered to in plant testing   2. Test run is carried out as per workplace procedures.   3. Adjustment are carried as per test run observations. |

**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** |
| --- | --- |
| Maintenance tools and equipment may include but not limited to: | * Spanners * Wrenches * Cyclic pliers * Pullers * Lathe machines * Welding machines |
| Materials may include but not limited to: | * Iron and steel * Welding rods * Bearings * Grease and oil. |
| Machine components may include but not limited to: | * Gears * Shafts * Pulleys * Coupling |

**REQUIRED KNOWLEDGE AND UNDERSTANDING**

The individual needs to demonstrate knowledge and understanding of:

|  |
| --- |
| * Functionality of machines * Types lubricants * Tools and equipment used in maintenance * Safety measures and precautions during maintenance * Machinery start up procedure * Machinery shutting down procedure * Maintenance of work area |

**FOUNDATION SKILLS**

|  |  |
| --- | --- |
| The individual needs to demonstrate the following additional skills: | |
| * Basic communication skills * Using appropriate fuel and lubricant requirement * Operating different plant machines * Use of PPE * Observing safety practices at workplace | * Decision making; * Report writing; * Creativity * Self-driven * Basic assessment of machine performance * Basic information record keeping * Basic data analysis and presentation * Basic digital Literacy |

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Used checklist in accordance to the expected inspections   2. Assembled maintenance tools, materials and equipment as per their functionality   3. Adhered to workshop safety in tools, materials and equipment handling   4. Performed maintenance of the faulty components as per their functionality |
| 1. Resource Implications | Resources the same as that of workplace are advised to be applied  Included: Maintenance tools, Stationeries, computers, lubricants, PPE, machines. |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Oral questioning   2. Practical demonstration   3. Observation   4. Written tests |
| 1. Context of Assessment | Competency may be assessed individually in the actual workplace or through simulated work environment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |