

**THE REPUBLIC OF KENYA**

**TVET CURRICULUM DEVELOPMENT, ASSESSMENT AND CERTIFICATION**

**COUNCIL (TVET CDACC)**

**NATIONAL OCCUPATIONAL STANDARDS**

**FOR**

**MECHANICAL PLANT TECHNICIAN**

**LEVEL 6**



TVET CDACC

P.O BOX 15745-00100

NAIROBI

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# FOREWORD

The provision of quality education and training is fundamental to the Government’s overall strategy for social economic development. Quality education and training will contribute to achievement of Kenya’s development blueprint, Vision 2030 and sustainable development goals.

Reforms in the education sector are necessary for the achievement of Kenya Vision 2030 and meeting the provisions of the Constitution of Kenya 2010. The education sector had to be aligned to the Constitution of Kenya 2010 and this resulted to the formulation of the Policy Framework for Reforming Education and Training. A key feature of this policy is the radical change in the design and delivery of the TVET training.

This policy document requires that training in TVET be competency based, curriculum development be industry led, certification be based on demonstration of competence and mode of delivery allows for multiple entry and exit in TVET programmes. These reforms demand that Industry takes a leading role in curriculum development to ensure the curriculum addresses its competence needs. It is against this background that these

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

**PRINCIPAL SECRETARY, VOCATIONAL AND TECHNICAL TRAINING**

**MINISTRY OF EDUCATION**

# PREFACE

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

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

The TVET Curriculum Development, Assessment and Certification Council (TVET CDACC), in conjunction with Plant Engineering Sector Skills Advisory Committee (SSAC) have developed these Occupational Standards for Mechanical Plant technician. These standards will be the bases for development of competency-based curriculum for Mechanical plant technician Level 6.

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

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

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

**CHAIRMAN, TVET CDACC**

# ACKNOWLEDGMENT

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

I thank TVET Curriculum Development, Assessment and Certification Council (TVET CDACC) for providing guidance on the development of these Standards. My gratitude goes to Mechanical Plant 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 participation of these Standards.

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

**CHAIRPERSON,**

**MECHANICAL ENGINEERING SECTOR SKILLS ADVISORY COMMITTEE**

# ACRONYMS

AC Air conditioning

BC Basic Competency

CC Common Competency

CR Core Competency

CDACC Curriculum Development, Assessment and Certification Council

CPU Control Powering Unit

DTI Dial test indicator

ENG Engineering

FOT Fixed orifice tube

GPS Global positioning system

ICT Information and Communication Technology

IT Information Technology

KCSE Kenya Certificate of Secondary Education

MPE Mechanical Plant Engineering

KNQF Kenya National Qualification Framework

KPI King Pin inclination

OBD On-board diagnostics

OS Occupational Standards

PPE Personal protective equipment

SI Spark ignition

TVET Technical and Vocational Education and Training

TQM Total Quality Management

SOP Standard Operating Procedures

# **KEY TO UNIT CODE**

**ENG/OS/MPE/BC /01/ 6/ A**

Industry or sector

Occupational Standards

Occupational area

Type of competency

Competency number

Competency level

Control version

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# OVERVIEW

The Mechanical Plant Technician Level 6 qualification consists of competencies that a person must achieve to enable him/her to workin mechanical plant.It entails designing of production plant, installing of mechanical plant machinery, maintenancing production plant, operating hydraulic and pneumatic systems, operating of plant machines/utilities, optimizing production systems, understanding Kaizen principles and managing spares and consumables inventory. The units of competency comprising Plant Technician certificate level 6 qualifications include the following basic, common and core competencies:

|  |  |
| --- | --- |
| **BASIC UNITS OF COMPETENCY** | |
| **Unit of competency Code** | **Units of competency** |
| ENG/OS/MPE/BC/01/6/A | Demonstrate communication skills |
| ENG/OS/MPE/BC/02/6/A | Demonstrate digital literacy |
| ENG/OS/MPE/BC/03/6/A | Demonstrate entrepreneurial skills |
| ENG/OS/MPE/BC/04/6/A | Demonstrate employability skills |
| ENG/OS/MPE/BC/05/6/A | Demonstrate environmental literacy |
| ENG/OS/MPE/BC/06/6/A | Demonstrate occupational health and safety |
| **COMMON UNITS OF COMPETENCY** | |
| ENG/OS/MPE/CC/01/6/A | Prepare and interpret technical drawing |
| ENG/OS/MPE/CC/02/6/A | Apply engineering mathematics |
| ENG/OS/MPE/CC/03/6/A | Apply mechanical science principles |
| ENG/OS/MPE/CC/04/6/A | Apply material science principles and perform metallurgical processes |
| ENG/OS/MPE/CC/05/6/A | Apply thermodynamics principles |
| ENG/OS/MPE/CC/06/6/A | Apply fluid mechanics principles |
| **CORE UNITS OF COMPETENCY** | |
| ENG/OS/MPE/CR/01/6/A | Design production plant |
| ENG/OS/MPE/CR/02/6/A | Install mechanical plant machineries |
| ENG/OS/MPE/CR/03/6/A | Perform plant maintenance |
| ENG/OS/MPE/CR/04/6/A | Maintain hydraulic and pneumatic systems |
| ENG/OS/MPE/CR/05/6/A | Operate plant machines/utilities |
| ENG/OS/MPE/CR/06/6/A | Optimize production systems |
| ENG/OS/MPE/CR/07/6/A | Apply kaizen principles |
| ENG/OS/MPE/CR/08/6/A | Perform workshop processes |
| ENG/OS/MPE/CR/09/6/A | Manage spares and consumables inventory |
| ENG/OS/MPE/CR/10/6/A | Manage plant production process |

# BASIC UNITS OF COMPETENCY

**DEMONSTRATE COMMUNICATION SKILLS**

**UNIT CODE: ENG/OS/MPE/BC/01/6/A**

**UNIT DESCRIPTION**

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

**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. Meet communication needs of clients and colleagues | 1.1 Specific communication needs of clients and colleagues are identified and met  1.2 Different approaches are used to meet communication needs of clients and colleagues  1.3 Conflict is addressed promptly and in a timely way and in a manner, which does not compromise the standing of the organization |
| 1. Develop communication strategies | * 1. Strategies for effective internal and external dissemination of information are developed to meet the organization’s requirements   2. Special communication needs are considered in developing strategies to avoid discrimination in the workplace   3. Communication ***strategies*** are analyzed, evaluated and revised where necessary to make sure they are effective |
| 1. Establish and maintain communication pathways | * 1. Pathways of communication are established to meet requirements of organization and workforce   2. Pathways are maintained and reviewed to ensure personnel are informed of relevant information |
| 1. Promote use of communication strategies | * 1. Information is provided to all areas of the organization to facilitate implementation of the strategy   2. Effective communication techniques are articulated and modelled to the workforce   3. Personnel are given guidance about adapting communication strategies to suit a range of contexts |
| 1. Conduct interview | 1. A range of appropriate communication strategies are employed in ***interview situations*** 2. Records of interviews are made and maintained in accordance with organizational procedures 3. Effective questioning, listening and nonverbal communication techniques are used to ensure that required message is communicated |
| 1. Facilitate group discussion | * 1. Mechanisms which enhance ***effective group interaction*** is defined and implemented   2. Strategies which encourage all group members to participate are used routinely   3. Objectives and agenda for meetings and discussions are routinely set and followed   4. Relevant information is provided to group to facilitate outcomes   5. Evaluation of group communication strategies is undertaken to promote participation of all parties   6. Specific communication needs of individuals are identified and addressed |
| 1. Represent the organization | 7.1 When participating in internal or external forums, presentation is relevant, appropriately researched and presented in a manner to promote the organization  7.2 Presentation is clear and sequential and delivered within a predetermined time  7.3 Appropriate media is utilized to enhance presentation  7.4 Differences in views are respected  7.5 Written communication is consistent with organizational standards  7.6 Inquiries are responded in a manner consistent with organizational standard |

**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**  May include but not limited to: |
| 1. Communication strategies 2. Interview situations include but not limited to: | * Language switch * Comprehension check * Repetition * Asking confirmation * Paraphrase * Clarification request * Translation * Restructuring * Approximation * Generalization |
| 1. Effective group interaction includes but not limited to: | * Identifying and evaluating what is occurring within an interaction in a nonjudgmental way * Using active listening * Making decision about appropriate words, behavior * Putting together response which is culturally appropriate * Expressing an individual perspective * Expressing own philosophy, ideology and background and exploring impact with relevance to communication |
| 1. Situations include but not limited to: | * Establishing rapport * Eliciting facts and information * Facilitating resolution of issues * Developing action plans * Diffusing potentially difficult situations |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skills:

* Effective communication
* Active listening
* Giving/receiving feedback
* Interpretation of information
* Role boundaries setting
* Negotiation
* Establishing empathy
* Openness and flexibility in communication
* Communication skills required to fulfill job roles as specified by the organization
* Writing communications strategy
* Applying key elements of communications strategy

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Communication process
* Dynamics of groups and different styles of group leadership
* Communication skills relevant to client groups
* Flexibility in communication
* Communication skills relevant to client groups

Key elements of communications strategy

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   1. Developed communication strategies to meet the organization requirements and applied in the workplace 2. Established and maintained communication pathways for effective communication in the workplace 3. Used communication strategies involving exchanges of complex oral information |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace or appropriately simulated environment where assessment can take place 2. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   1. Direct Observation/Demonstration with Oral Questioning 2. Written Examination |
| 1. Context of Assessment | Competency may be assessed individually in the actual workplace or through accredited institution |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

|  |  |
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|  |  |

**DEMONSTRATE DIGITAL LITERACY**

**UNIT CODE:** ENG/OS/MPE/BC/02/6/A

**UNIT DESCRIPTION**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

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

**RANGE**

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

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Appropriate computer software may include but not limited to: | A collection of instructions or computer tools that enable the user to interact with a *computer*, its hardware, or perform tasks. |
| 1. Appropriate computer hardware may include but not limited to: | Collection of physical parts of a computer system such as;   * Computer case, monitor, keyboard, and mouse * All the parts inside the computer case, such as the hard disk drive, motherboard and video card |
| 1. Data security and privacy may include but not limited to: | * Confidentiality of data * Cloud computing * Integrity -but-curious data surfing |
| 1. Security and control measures may include but not limited to: | * Counter measures against cyber terrorism * Risk reduction * Cyber threat issues * Risk management * Pass-wording |
| 1. Security threats may include but not limited to: | * Cyber terrorism * Hacking |
| 1. Word processing concepts may include but not limited to: | Using a special program to create, edit and print documents |
| 1. 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:

* Software concept
* Functions of computer software and hardware
* Data security and privacy
* Computer security threats and control measures
* Technology underlying cyber-attacks and networks
* Cyber terrorism
* Computer crimes
* Detection and protection of computer crimes
* Laws governing protection of ICT
* Word processing;
* Functions and concepts of word processing.
* Documents and tables creation and manipulations
* Mail merging
* Word processing utilities
* Spread sheets;
* Meaning, formulae, function and charts, uses and layout
* Data formulation, manipulation and application to cells
* Database;
* Database design, data manipulation, sorting, indexing, storage retrieval and security
* Desktop publishing;
* Designing and developing desktop publishing tools
* Manipulation of desktop publishing tools
* Enhancement of typeset work and printing documents
* Presentation Packages;
* Types of presentation Packages
* Creating, formulating, running, editing, printing and presenting slides and handouts
* Networking and Internet;
* Computer networking and internet.
* Electronic mail and world wide web
* Emerging trends and issues in ICT;
* Identify and integrate emerging trends and issues in ICT
* Challenges posed by emerging trends and issues

**EVIDENCE** **GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Identified and controlled security threats   2. Detected and protected computer crimes   3. Applied word processing in office tasks   4. Designed, prepared work sheet and applied data to the cells in accordance to workplace procedures   5. Opened electronic mail for office communication as per workplace procedure   6. Installed internet and World Wide Web for office tasks in accordance with office procedures   7. Integrated emerging issues in computer ICT applications   8. Applied laws governing protection of ICT |
| 1. Resource Implications | * 1. Tablets   2. Laptops and   3. Desktop PCs   4. Desktop computer   5. Lap top   6. Calculator   7. Internet   8. Smart phone   9. Operations Manuals |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Written Test   2. Demonstration   3. Practical assignment   4. Interview/Oral Questioning   5. Demonstration |
| 1. Context of Assessment | Competency may be assessed in an off and on the job setting |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

**DEMONSTRATE UNDERSTANDING OF ENTREPRENEURSHIP**

**UNIT CODE :** ENG/OS/MPE/BC/03/6/A

**UNIT DESCRIPTION**

This unit covers the competencies required to demonstrate understanding of entrepreneurship. It involves demonstrating understanding of an entrepreneur, entrepreneurship and self-employment. It also involves identifying entrepreneurship opportunities, creating entrepreneurial awareness, applying entrepreneurial motivation and developing business innovative strategies.

**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. Demonstrate understanding of an Entrepreneur | * 1. Entrepreneurs and Business persons are distinguished as per ***principles of entrepreneurship***   2. ***Types of entrepreneurs*** are identified as per principles of entrepreneurship   3. Ways of becoming an Entrepreneur are identified as per principles of Entrepreneurship   4. ***Characteristics of Entrepreneurs*** are identified as per principles of Entrepreneurship   5. Factors affecting Entrepreneurship development are explored as per principles of Entrepreneurship |
| 1. Demonstrate understanding of Entrepreneurship and self-employment | 1. Entrepreneurship and self-employment are distinguished as per principles of entrepreneurship 2. Importance of self-employment is analysed based on business procedures and strategies 3. ***Requirements for entry into self-employment*** are identified according to business procedures and strategies 4. Role of an Entrepreneur in business is determined according to business procedures and strategies 5. Contributions of Entrepreneurs to National development are identified as per business procedures and strategies 6. Entrepreneurship culture in Kenya is explored as per business procedures and strategies 7. Born or made Entrepreneurs are distinguished as per entrepreneurial traits |
| 1. Identify Entrepreneurship opportunities | 1. Sources of business ideas are identified as per business procedures and strategies 2. ***Business ideas*** and opportunities are generated as per business procedures and strategies 3. Business life cycle is analysed as per business procedures and strategies 4. Legal aspects of business are identified as per procedures and strategies 5. Product demand is assessed as per market strategies 6. Types of ***business environment*** are identified and evaluated as per business procedures 7. Factors to consider when evaluating business environment are explored based on business procedure and strategies 8. Technology in business is incorporated as per best practice |
| 1. Create entrepreneurial awareness | 1. ***Forms of businesses*** are explored as per business procedures and strategies 2. Sources of business finance are identified as per business procedures and strategies 3. Factors in selecting source of business finance are identified as per business procedures and strategies 4. ***Governing policies*** on Small Scale Enterprises (SSEs) are determined as per business procedures and strategies 5. Problems of starting and operating SSEs are explored as per business procedures and strategies |
| 1. Apply entrepreneurial motivation | 1. ***Internal and external motivation*** factors are determined in accordance with ***motivational theories*** 2. Self-assessment is carried out as per ***entrepreneurial orientation*** 3. Effective communications are carried out in accordance with ***communication principles*** 4. Entrepreneurial motivation is applied as per motivational theories |
| 1. Develop innovative business strategies | 1. Business innovation strategies are determined in accordance with the organization strategies 2. Creativity in business development is demonstrated in accordance with business strategies 3. ***Innovative business strategies*** are developed as per business principles 4. Linkages with other entrepreneurs are created as per best practice 5. ICT is incorporated in business growth and development as per best practice |
| 1. Develop Business Plan | 1. Identified Business is described as per business procedures and strategies 2. Marketing plan is developed as per business plan format 3. Organizational/Management plan is prepared in accordance with business plan format 4. Production/operation plan in accordance with business plan format 5. Financial plan is prepared in accordance with the business plan format 6. Executive summary is prepared in accordance with business plan format 7. Business plan is presented as per best practice |

**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**  include but not limited to: |
| * Types of entrepreneurs but not limited to: | * Innovators * Imitators * Craft * Opportunistic * Speculators |
| * Principles of Entrepreneurship but not limited to: | * Visionary * Solution provider * Accountability * Growth and marketing * Resilient * Tenacious |
| * Characteristics of Entrepreneurs include but not limited to: | * Creative * Innovative * Planner * Risk taker * Networker * Confident * Flexible * Persistent * Patient * Independent * Future oriented * Goal oriented |
| * Requirements for entry into self-employment | * Technical skills * Management skills * Entrepreneurial skills * Resources * Infrastructure |
| * Internal motivation include but not limited to: | * Interest * Passion * Freedom * Prestige |
| * Business environment | * External * Internal * Intermediate |
| * Forms of businesses | * Sole proprietorship * Partnership * Limited companies * Cooperatives |
| * Governing policies | * Increasing scope for finance * Promoting cooperation between entrepreneurs and private sector * Reducing regulatory burden on entrepreneurs * Developing IT tools for entrepreneurs |
| * External motivation include but not limited to: | * Rewards * Punishment * Enabling environment * Government policies |
| * Entrepreneurial orientation include but not limited to: | * Passion * Interest * Hobbies * Skills |
| * Innovative business strategies include but not limited to: | * New products * New methods of production * New markets * New sources of supplies * Change in industrialization |
| * Communication principles include but not limited to: | * Feed back * Attention * Clarity * Timeliness * Adequacy * Consistency * Informality |
| * Motivational theories include but not limited to: | * Marslows theory * McClelland theory * Fredrick Tylors theory |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skills:

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

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Entrepreneurial competencies
* Decision making
* Business communication
* Change management
* Coping with competition
* Risk taking
* Net working
* Time management
* Leadership
* Factors affecting entrepreneurship development
* Principles of Entrepreneurship
* Features and benefits of common operational practices, e. g., continuous improvement (kaizen), waste elimination,
* Conflict resolution
* Health, safety and environment (HSE) principles and requirements
* Customer care strategies
* Basic financial management
* Business strategic planning
* Impact of change on individuals, groups and industries
* Government and regulatory processes
* Local and international market trends
* Product promotion strategies
* Market and feasibility studies
* Government and regulatory processes
* Local and international business environment
* Concepts of change management
* Relevant developments in other industries
* Regional/ County business expansion strategies
* Innovation in business

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   1. Distinguished entrepreneurs and business persons correctly 2. Identified ways of becoming an entrepreneur appropriately 3. Explored factors affecting entrepreneurship development appropriately 4. Analysed importance of self-employment accurately 5. Identified requirements for entry into self-employment correctly 6. Identified sources of business ideas correctly 7. GeneratedBusiness ideas and opportunities correctly 8. Analysed business life cycle accurately 9. Identified legal aspects of business correctly 10. Assessed product demand accurately 11. Determined Internal and external motivation factors appropriately 12. Carried out communications effectively 13. Identified sources of business finance correctly 14. Determined Governing policy on small scale enterprise appropriately 15. Explored problems of starting and operating SSEs effectively 16. Developed Marketing, Organizational/Management, Production/Operation and Financial plans correctly 17. Prepared executive summary correctly 18. Determined business innovative strategies appropriately 19. Presented business plan effectively |
| 1. Resource Implications | The following resources should be provided:   1. Check list 2. Research tools (Questionnaire, interview guide, observation schedule) 3. Materials, tools, equipment and machines relevant |
| 1. Methods of Assessment | 1. Written tests 2. Observation 3. Oral questions 4. Third party report 5. Interviews 6. Case problems 7. Portfolio |
| 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 |
| 5. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

**DEMONSTRATE EMPLOYABILITY SKILLS**

**UNIT CODE:** ENG/OS/MPE/BC/04/6/A

**UNIT DESCRIPTON**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 1. Conduct self-management | 1. Personal vision, mission and goals are formulated based on potential and in relation to organization objectives 2. Emotions are managed as per workplace requirements 3. Individual performance is evaluated and monitored according to the agreed targets. 4. Assertiveness is developed and maintained based on the requirements of the job. 5. Accountability and responsibility for own actions are demonstrated. 6. Self-esteem and a positive self-image are developed and maintained. 7. Time management, attendance and punctuality are observed as per the organization policy. 8. Goals are managed as per the organization’s objective 9. Self-strengths and weaknesses are identified as per ***personal objectives*** 10. Critics are managed as per personal objectives |
| 1. Demonstrate interpersonal communication | 1. Listening and understanding is demonstrated as per communication policy 2. Writing to the needs of the audience is demonstrated as per communication policy 3. Speaking, reading and writing is demonstrated as per communication policy 4. Negotiation skills are demonstrated as per communication policy 5. Empathizing is demonstrated as per the communication policy 6. Numeracy is applied as per the communication policy 7. Internal and external customers’ needs are identified and interpreted as per the communication policy 8. Persuasion is demonstrated as per the communication policy 9. Communication networks are established as per the SOPs 10. Information is shared as per communication structure |
| 1. Demonstrate critical safe work habits | * 1. Stress is managed in accordance with workplace procedures.   2. Punctuality and time consciousness is demonstrated in line with workplace policy.   3. Personal objectives are integrated with organization goals based on organization’s strategic plan.   4. ***Resources*** are utilized in accordance with workplace policy.   5. Work priorities are set in accordance to workplace procedures.   6. Leisure time is recognized in line with organization policy.   7. Abstinence from ***drug and substance abuse*** is observed as per workplace policy.   8. Awareness of HIV and AIDS is demonstrated in line with workplace requirements.   9. Safety consciousness is demonstrated in the workplace based on organization safety policy.   10. ***Emerging issues*** are dealt with in accordance with organization policy. |
| 1. Lead a workplace team | 1. Performance expectations for the ***team*** are set 2. Duties and responsibilities are assigned in accordance with the organization policy. 3. Team parameters and ***relationships*** are identified according to set rules and regulations. 4. ***Forms of communication*** in a team are established according to office policy. 5. Communication is carried out as per workplace place policy and requirements of the job. 6. Team performance is supervised 7. ***Feedback*** on performance is collected and analyzed based on established team learning process 8. Conflicts are resolved between team members in line with organization rules and regulations. 9. ***Gender mainstreaming*** is undertaken in accordance with set regulations. 10. Human rights are adhered to in accordance with existing protocol. 11. Healthy relationships are developed and maintained for harmonious co-existence in line with workplace. |
| 1. Plan and organize work | 1. Task requirements are identified as per the workplace objectives 2. Task is interpreted in accordance with safety (OHS ), environmental requirements and quality requirements 3. Work activity is organized with other involved personnel as per the SOPs 4. Resources are mobilized, allocated and utilized to meet project goals and deliverables. 5. Work activities are monitored and evaluated in line with organization procedures. 6. Job planning is documented in accordance with workplace requirements. 7. Planning and organizing of work activities is reviewed as per the workplace requirements 8. Time is managed achieve workplace set goals and objectives. |
| 1. Maintain professional growth and development | * 1. Personal training needs are identified and assessed in line with the requirements of the job.   2. ***Training and career opportunities*** are identified and availed based on job requirements.   3. Resources for training are mobilized and allocated based organizations skills needs.   4. Licensees and certifications relevant to job and career are obtained and renewed.   5. ***Personal growth*** is pursued towards improving the qualifications set for the profession.   6. Work priorities and commitments are managed based on requirement of the job and workplace policy.   7. Recognitions are sought as proof of career advancement in line with professional requirements. |
| 1. Demonstrate workplace learning | * 1. Own learning is managed as per workplace policy.   2. Learning opportunities are sought and allocated based on job requirement and in line with organization policy.   3. Contribution to the learning community at the workplace is carried out.   4. ***Range of media for learning*** are established as per the training need   5. Application of learning is demonstrated in both technical and non-technical aspects based on requirements of the job   6. Enthusiasm for ongoing learning is demonstrated   7. Time and effort is invested in learning new skills-based job requirements   8. Willingness to learn in different context is demonstrated based on available learning opportunities arising in the workplace.   9. Awareness of Occupational Health and Safety procedures are demonstrated in use of technology in the workplace.   10. Initiative is taken to create more effective and efficient processes and procedures in line with workplace policy.   11. New systems are developed and maintained in accordance with the requirements of the job.   12. Opportunities that are not obvious are identified and exploited in line with organization objectives.   13. Opportunities for performance improvement are identified proactively in area of work.   14. Awareness of personal role in workplace ***innovation*** is demonstrated. |
| 1. Demonstrate problem solving skills | * 1. Creative, innovative and practical solutions are developed based on the problem   2. Independence and initiative in identifying and solving problems is demonstrated.   3. Team problems are solved as per the workplace guidelines   4. Problem solving strategies are applied as per the workplace guidelines   5. Problems are analyzed and assumptions tested as per the context of data and circumstances |
| 1. Manage workplace ethics | * 1. Policies and guidelines are observed as per the workplace requirements   2. Self-worth and profession is exercised in line with personal goals and organizational policies   3. Code of conduct is observed as per the workplace requirements   4. Personal and professional integrity is demonstrated as per the personal goals   5. Commitment to jurisdictional laws is demonstrated as per the workplace requirements |

**RANGE**

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

|  |  |
| --- | --- |
| **Range** | **Variable** |
| * ***Drug and substance abuse*** include but not limited to: | Commonly abused   * Alcohol * Tobacco * Miraa * Over-the-counter drugs * Cocaine * Bhang * Glue |
| * ***Feedback*** includes but not limited to: | * Verbal * Written * Informal * Formal |
| * ***Relationships*** includes but not limited to: | * Man/Woman * Trainer/trainee * Employee/employer * Client/service provider * Husband/wife * Boy/girl * Parent/child * Sibling relationships |
| * ***Forms of communication*** include but not limited to: | * Written * Visual * Verbal * Non verbal * Formal and informal |
| * ***Team*** includes but not limited to: | * Small work group * Staff in a section/department * Inter-agency group |
| * ***Personal growth*** includes but not limited to: | |  | | --- | | * Growth in the job * Career mobility * Gains and exposure the job gives * Net workings * Benefits that accrue to the individual as a result of noteworthy performance | |
| * ***Personal objectives*** include but not limited to: | * Long term * Short term * Broad * Specific |
| * ***Trainings and career opportunities*** includes but not limited to | * Participation in training programs * Technical * Supervisory * Managerial * Continuing Education * Serving as Resource Persons in conferences and workshops |
| * ***Resource*** include but not limited to: | * Human * Financial * Technology * Hardware * Software |
| * ***Innovation*** include but not limited to: | * New ideas * Original ideas * Different ideas * Methods/procedures * Processes * New tools |
| * ***Emerging issues*** include but not limited to: | * Terrorism * Social media * National cohesion * Open offices |
| * ***Range of media for learning*** include but not limited to: | * Mentoring * peer support and networking * IT and courses |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skills:

* Personal hygiene practices
* Intra and Interpersonal skills
* Communication skills
* Knowledge management
* Interpersonal skills
* Critical thinking skills
* Observation skills
* Organizing skills
* Negotiation skills
* Monitoring skills
* Evaluation skills
* Record keeping skills
* Problem solving skills
* Decision Making skills
* Resource utilization skills
* Resource mobilization skills

**Required Knowledge**

The individual needs to demonstrate knowledge of:

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

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   * 1. Conducted self-management   2. Demonstrated interpersonal communication   3. Demonstrated critical safe work habits   4. Demonstrated the ability to lead a workplace team   5. Planned and organized work   6. Maintained professional growth and development   7. Demonstrated workplace learning   8. Demonstrated problem solving skills   9. Demonstrated the ability to manage ethical performance |
| 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 2. Interview 3. Observation 4. Third Party Reports 5. Written |
| 1. Context of Assessment | * 1. Competency may be assessed in workplace or in a simulated workplace setting   2. Assessment shall be observed while tasks are being undertaken whether individually or in-group |
| 1. Guidance information for assessment | | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

**DEMONSTRATE ENVIRONMENTAL LITERACY**

**UNIT CODE:** ENG/OS/MPE/BC/05/6/A

**UNIT DESCRIPTION**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 1. Control environmental hazard | 1.1 ***Storage methods*** for environmentally hazardous materials are strictly followed according to environmental regulations and OSHS.  1.2 ***Disposal methods*** of hazardous wastes are followed at all times according to environmental regulations and OSHS.  1.3 ***PPE*** is used according to OSHS. |
| 1. Control environmental Pollution control | * 1. Environmental pollution ***control measures*** are compiled following standard protocol.   2. Procedures for solid waste management are observed according Environmental Management and Coordination Act 1999   3. Methods for minimizing ***noise pollution*** complied following environmental regulations. |
| 1. Demonstrate sustainable resource use | * 1. Methods for minimizing wastage are complied with.   2. Waste management procedures are employed following principles of 3Rs (Reduce, Reuse, Recycle)   3. Methods for economizing or reducing resource consumption are practiced. |
| 1. Evaluate current practices in relation to resource usage | * 1. Information on resource efficiency systems and procedures are collected and provided to the work group where appropriate.   2. Current resource usage is measured and recorded by members of the work group.   3. Current purchasing strategies are analyzed and recorded according to industry procedures.   4. Current work processes to access information and data is analyzed following enterprise protocol. |
| 1. Identify Environmental legislations/conventions for environmental concerns | 5.1 Environmental legislations/conventions and local ordinances are identified according to the different environmental aspects/impact  5.2 Industrial standard/environmental practices are described according to the different environmental concerns |
| 1. Implement specific environmental programs | 6.1 Programs/Activities are identified according to organizations policies and guidelines.  6.2 Individual roles/responsibilities are determined and performed based on the activities identified.  6.3 Problems/constraints encountered are resolved in accordance with organizations’ policies and guidelines  6.4 Stakeholders are consulted based on company guidelines |
| 1. Monitor activities on Environmental protection/Programs | 7.1 Activities are periodically monitored and Evaluated according to the objectives of the environmental program  7.2 Feedback from stakeholders are gathered and considered in Proposing enhancements to the program based on consultations  7.3 Data gathered are analyzed based on Evaluation requirements  7.4 Recommendations are submitted based on the findings  7.5 Management support systems are set/established to sustain and enhance the program  7.6 Environmental incidents are monitored and reported to  concerned/proper authorities |
| 1. Analyze resource use | 8.1. All resource consuming processes are Identified  8.2. Quantity and nature of Resource consumed is determined  8.3. Resource flow is analyzed through different parts of the process.  8.4. Wastes are classified for possible source of resources. |
| 1. Develop resource Conservation plans | 9.1. Efficiency of use/conversion of resources is determined following industry protocol.  9.2. Causes of low efficiency of use of resources are  Determined based on industry protocol.  9.3. Plans for increasing the efficiency of resource use are developed based on findings. |

**RANGE**

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

|  |  |
| --- | --- |
| **Variable** | **Range**  May include but not limited to |
| * 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 |
| * Environmental pollution control measures may include but are not limited to: | 2.1 Methods for minimizing or stopping spread and ingestion of airborne particles  2.2 Methods for minimizing or stopping spread and ingestion of gases and fumes  2.4 Methods for minimizing or stopping spread and ingestion of liquid wastes |
| * Wastes may include but are not limited to: | 3.1 Unnecessary waste  3.2 Necessary waste |
| * Waste management Proceduresmay include but are not limited to: | 4.1 Sorting  4.2 Storing of items  4.2 Recycling of items  4.3 Disposal of items |
| * Resources may include but are not limited to: | 5.1 Electric  5.2 Water  5.3 Fuel  5.4 Telecommunications  5.5 Supplies  5.6 Materials |
| * Workplace environmental hazards may include but are not limited to: | 6.1Biological hazards  6.2 Chemical and dust hazards  6.3 Physical hazards |
| * Organizational systems and proceduresmay include but are not limited to: | 7.1 Supply chain, procurement and purchasing  7.2 Quality assurance  7.3 Making recommendations and seeking approvals |
| * Legislations/Conventions may include but are not limited to: | 8.1 EMCA 1999  8.2 Montreal Protocol  8.3 Kyoto Protocol |
| * Environmental aspects/impacts may include but are not limited to: | 9.1 Air pollution  9.2 Water pollution  9.3 Noise pollution  9.4 Solid waste  9.5 Flood control  9.6 Deforestation/Denudation  9.7 Radiation/Nuclear /Radio Frequency/ Microwaves  9.8 Situation  9.9 Soil erosion (e.g. Quarrying, Mining, etc.)  9.10 Coral reef/marine life protection |
| * Industrial standards / Environmental practices may include but are not limited to: | 10.1 ISO standards  10.2 Company environmental management systems  (EMS) |
| * Periodic may include but are not limited to: | 11.1 hourly  11.2 daily  11.3 weekly  11.4 monthly  11.5 quarterly  11.6 yearly |
| * Programs/Activities may include but are not limited to: | 12.1 Waste disposal (on-site and off-site)  12.2 Repair and maintenance of equipment  12.3 Treatment and disposal operations  12.4 Clean-up activities  12.5 Laboratory and analytical test  12.6 Monitoring and evaluation  12.7 Environmental advocacy programs |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skills:

* Following storage methods of environmentally hazardous materials
* Following disposal methods of hazardous wastes
* Using PPE
* Practicing OSHS
* Complying environmental pollution control
* Observing solid waste management
* Complying methods of minimizing noise Pollution
* Complying methods of minimizing wastage
* Employing waste management procedures
* Economizing resource consumption
* Listing of resources used
* Measuring current usage of resources
* Identifying and reporting workplace environmental hazards
* Conveying all environmental issues
* Following environmental regulations
* Identifying environmental regulations
* Assessing procedures for assessing compliance
* Collecting information on environmental and resource efficiency systems and procedures, and Providing information to the work group
* Measuring and recording current resource usage
* Analysing and recording current purchasing strategies.
* Analysing current work processes to access information and data and Assisting identifying areas for improvement
* Analysing resource flow
* Determining efficiency of use/conversion of resources
* Determining causes of low efficiency of use
* Developing plans for increasing the efficiency of resource use
* Checking resource use plans
* Complying to regulations/licensing requirements
* Determining benefit/cost of plans
* Ranking proposals based on benefit/cost compared to limited resources
* Checking proposals meet regulatory requirements
* Monitoring implementation
* Making adjustments to plan and implementation
* checking new resource usage

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Storage methods of environmentally hazardous materials
* Disposal methods of hazardous wastes
* Usage of PPE Environmental regulations
* OSHS
* Types of pollution
* Environmental pollution control measures
* Different solid wastes
* Solid waste management
* Different noise pollution
* Methods of minimizing noise pollution
* Methods of minimizing wstage
* Waste management procedures
* Economizing of resource consumption
* Principle of 3Rs
* Types of resources
* Techniques in measuring current usage of resources
* Calculating current usage of resources
* Types of workplace environmental hazards
* Environmental regulations
* Environmental regulations applying to the enterprise.
* Procedures for assessing compliance with environmental regulations.
* Collection of information on environmental and resource efficiency systems and procedures,
* Measurement and recording of current resource usage
* Analysis and recording of current purchasing strategies.
* Analysis current work processes to access information and data Analysis of data and information
* Identification of areas for improvement
* Resource consuming processes
* Determination of quantity and nature of resource consumed
* Analysis of resource flow of different parts of the resource flow process
* Use/conversion of resources
* Causes of low efficiency of use
* Increasing the efficiency of resource use
* Inspection of resource use plans
* Regulations/licensing requirements
* Determine benefit/cost for alternative resource sources
* Benefit/costs for different alternatives
* Components of proposals
* Criteria on ranking proposals
* Regulatory requirements
* Proposals for improving resource efficiency
* Implementation of resource efficiency plans
* Procedures in monitor implementation
* Adjustments of implementation plan
* Inspection of new resource usage

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Controlled environmental hazard   2. Controlled environmental pollution   3. Demonstrated sustainable resource use   4. Evaluated current practices in relation to resource usage   5. Demonstrated knowledge of environmental legislations and local ordinances according to the different environmental issues /concerns.   6. Described industrial standard environmental practices according to the different environmental issues/concerns.   7. Resolved problems/ constraints encountered based on management standard procedures   8. Implemented and monitored environmental practices on a periodic basis as per company guidelines   9. Recommended solutions for the improvement of the program   10. Monitored and reported to proper authorities any environmental incidents |
| 1. Resource Implications | The following resources should be provided:   * 1. Workplace with storage facilities   2. Tools, materials and equipment relevant to the tasks (e.g. Cleaning tools, cleaning materials, trash bags)   3. PPE, manuals and references   4. Legislation, policies, procedures, protocols and localordinances relating to environmental protection   5. Case studies/scenarios relating to environmental Protection |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   * 1. Demonstration   2. Oral questioning   3. Written examination   4. Interview/Third Party Reports   5. Portfolio (citations/awards from GOs and NGOs, certificate of training – local and abroad)   6. Simulations and role-play |
| 1. Context of Assessment | Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment. |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

**DEMONSTRATE OCCUPATIONAL SAFETY AND HEALTH PRACTICES**

**UNIT CODE:** ENG/OS/MPE/BC/06/6/A

**UNIT DESCRIPTION**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

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

**RANGE**

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

|  |  |
| --- | --- |
| Variable | **Range** |
| 1. Hazards may include but are not limited to: | 1.1. Physical hazards – impact, illumination, pressure, noise,  vibration, extreme temperature, radiation  1.2 Biological hazards- bacteria, viruses, plants, parasites, mites, molds, fungi, insects  1.3 Chemical hazards – dusts, fibers, mists, fumes, smoke,  gasses, vapors  1.4 Ergonomics  Psychological factors – over exertion/ excessive force,  awkward/static positions, fatigue, direct pressure,  varying metabolic cycles  Physiological factors – monotony, personal  relationship, work out cycle  1.6 Safety hazards (unsafe workplace condition) –  confined space, excavations, falling objects, gas  leaks, electrical, poor storage of materials and  waste, spillage, waste and debris  1.7 Unsafe workers’ act (Smoking in off-limited areas, Substance and alcohol abuse at work) |
| 1. Indicators may include but are not limited to: | 2.1 Increased of incidents of accidents, injuries  2.2 Increased occurrence of sickness or health complaints/ symptoms  2.3 Common complaints of workers related to OSH  2.4 High absenteeism for work-related reasons |
| 1. Evaluation and/or work environment measurements may include but are not limited to: | 3.1 Health Audit  3.2 Safety Audit  3.3 Work Safety and Health Evaluation  3.4 Work Environment Measurements of Physical and Chemical  Hazards |
| 1. OSH issues and/or concerns may include but are not limited to: | 4.1 Workers’ experience/observance on presence of work hazards  4.2 Unsafe/unhealthy administrative arrangements (prolonged work hours, no break time, constant overtime, scheduling of tasks)  4.3 Reasons for compliance/non-compliance to use of PPEs or other OSH procedures/policies/guidelines |
| 1. Prevention and control measures may include but are not limited to: | 5.1 Eliminate the hazard (i.e., get rid of the dangerous machine  5.2 Isolate the hazard (i.e. keep the machine in a closed room and operate it remotely; barricade an unsafe area off)  5.3 Substitute the hazard with a safer alternative (i.e., replace the machine with a safer one)  5.4 Use administrative controls to reduce the risk (i.e. give trainings on how to use equipment safely; OSH-related topics, issue warning signages, rotation/shifting work schedule)  5.5 Use engineering controls to reduce the risk (i.e. use safety guards to machine)  5.6 Use personal protective equipment  5.7 Safety, Health and Work Environment Evaluation  5.8 Periodic and/or special medical examinations of workers |
| 1. Safety gears /PPE (Personal Protective Equipment) may include but are not limited to: | 6.1 Arm/Hand guard, gloves  6.2 Eye protection (goggles, shield)  6.3 Hearing protection (ear muffs, ear plugs)  6.4 Hair Net/cap/bonnet  6.5 Hard hat  6.6 Face protection (mask, shield)  6.7 Apron/Gown/coverall/jump suit  6.8 Anti-static suits   * 1. High-visibility reflective vest |
| 1. Appropriate risk controls | Appropriate risk controls in order of impact are as follows:  7.1 Eliminate the hazard altogether (i.e., get rid of the dangerous machine)  7.2 Isolate the hazard from anyone who could be harmed (i.e., keep the machine in a closed room and operate it remotely; barricade an unsafe area off)  7.3 Substitute the hazard with a safer alternative (i.e., replace the machine with a safer one)  7.4 Use administrative controls to reduce the risk (i.e., train workers how to use equipment safely; train workers about the risks of harassment; issue signage)  7.5 Use engineering controls to reduce the risk (i.e., attach guards to the machine to protect users)  7.6 Use personal protective equipment (i.e., wear  gloves and goggles when using the machine) |
| 1. Contingency measures may include but are not limited to: | 8.1 Evacuation  8.2 Isolation  8.3 Decontamination  8.4 (Calling designed) emergency personnel |
| 1. Emergency procedures may include but are not limited to: | 9.1 Fire drill  9.2 Earthquake drill  9.3 Basic life support/CPR  9.4 First aid  9.5 Spillage control  9.6 Decontamination of chemical and toxic  9.7 Disaster preparedness/management  9.8 se of fire-extinguisher |
| 1. Incidents and emergencies may include but are not limited to: | 10.1 Chemical spills  10.2 Equipment/vehicle accidents  10.3 Explosion  10.4 Fire  10.5 Gas leak  10.6 Injury to personnel  10.7 Structural collapse  10.8 Toxic and/or flammable vapors emission. |
| 1. OSH-related Records may include but are not limited to: | 11.1 Medical/Health records  11.2 Incident/accident reports  11.3 Sickness notifications/sick leave application  11.4 OSH-related trainings obtained |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skills:

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

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* General OSH Principles
* Occupational hazards/risks recognition
* OSH organizations providing services on OSH evaluation and/or work environment measurements (WEM)
* National OSH regulations; company OSH policies and protocols
* Systematic gathering of OSH issues and concerns
* General OSH principles
* National OSH regulations
* Company OSH and recording protocols, procedures and policies/guidelines
* Training and/or counseling methodologies and strategies

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   1. Identifies hazards/risks in the workplace and/or its indicators 2. Requests for evaluation and/or work environment measurements of OSH hazards/risk in the workplace 3. Gathers OSH issues and/or concerns raised by workers 4. Identifies and implements prevention and control measures, including use of PPE (personal protective equipment) for specific hazards 5. Recommends appropriate risk controls based on result of OSH hazard evaluation and OSH issues gathered 6. Establish contingency measures, including emergency procedures in accordance with organization procedures 7. Provides information to work team about company OSH program, procedures and policies/guidelines 8. Participates in the implementation of OSH procedures and policies/guidelines 9. Trains and advises team members on OSH standards and procedures 10. Implements procedures for maintaining OSH-related records |
| 1. Resource Implications | The following resources should be provided:  2.1 Workplace or assessment location  2.2 OSH personal records  2.3 PPE  2.4 Health records |
| 1. Methods of Assessment | Competency may be assessed through:  3.1 Portfolio Assessment  3.2 Interview  3.3 Case Study/Situation  3.4 Observation/Demonstration and oral questioning |
| 1. Context of Assessment | Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment. |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# COMMON UNITS OF COMPETENCY

## PREPARE AND INTERPRET TECHNICAL DRAWINGS

**UNIT CODE:** ENG/OS/MPE/CC/01/6/A

**Unit description**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

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

**RANGE**

| **Variable** | **Range** |
| --- | --- |
| * Drawing equipment may include but not limited to: | * Drawing boards * T-square * Set squares * Drawing set * Computers with CAD packages |
| * Drawing materials may include but not limited to: | * Drawing papers * Pencils * Erasers * Masking tapes * Paper clips |
| * Environmental legislations may include but not limited to: | EMCA 1999 |
| * Personal Protective Equipment may include but not limited to: | * Dust coats * Closed leather shoes * Goggles for CAD |
| * Geometric forms may include but not limited to: | * Circles * Triangles * Rectangles * Parallelogram * Polygons * Pyramids * Conic sections * Prisms * Loci |
| * Standard drawing conventions may include but not limited to: | * Anatomy of engineering drawing (title block, coordinate grid system, revision block, notes and legends) * Drawing scale (paper size and drawing symbols) * International drawing standards |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required skills**

The individual needs to demonstrate the following skills:

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

**Required knowledge**

The individual needs to demonstrate knowledge of:

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

**EVIDENCE GUIDE**

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

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

## APPLY ENGINEERING MATHEMATICS

**UNIT CODE:** ENG/OS/MPE/CC/02/6/A

**Unit description:**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range.*** |
| --- | --- |
| * 1. Apply Algebra | * 1. Calculations involving Indices are performed as per the concept   2. Calculations involving Logarithms are performed as per the concept   3. Scientific calculator is used in solving mathematical problems in line with manufacturer’s manual   4. Simultaneous equations are performed as per the rules   5. Quadratic equations are calculated as per the concept   6. Permutations and combinations are performed |
| * 1. Apply Trigonometry and hyperbolic functions | * 1. Calculations are performed using trigonometric rules   2. Calculations are performed using hyperbolic functions |
| * 1. Apply complex numbers | 3.1 Complex numbers are represented using Argand diagrams  3.2 Operations involving complex numbers are performed  3.3 Calculations involving complex numbers are performed using De Moivre’s theorem |
| * 1. Apply Coordinate Geometry | * 1. Polar equations are calculated using coordinate geometry   2. Graphs of given polar equations are drawn using the Cartesian plane   3. Normal and tangents are determined using coordinate geometry |
| * 1. Carry out Binomial Expansion | * 1. Roots of numbers are determined using binomial theorem   2. Errors of small changes are determined using binomial theorem |
| * 1. Apply Calculus | * 1. Derivatives of functions are determined using Differentiation   2. Derivatives of hyperbolic functions are determined using Differentiation   3. Derivatives of inverse trigonometric functions are determined using Differentiation   4. Rate of change and small change are determined using Differentiation.   5. Calculation involving stationery points of functions of two variables are performed using differentiation.   6. Integrals of algebraic functions are determined using integration   7. Integrals of trigonometric functions are determined using integration   8. Integrals of logarithmic functions are determined using integration   9. Integrals of hyperbolic and inverse functions are determined using integration |
| * 1. Solve Ordinary differential equations | * 1. First order and second order differential equations are solved using the method of undetermined coefficients   7.2 First order and second order differential equations are solved from given boundary conditions |
| * 1. Carry out Mensuration | * 1. Perimeter and areas of figures are obtained   2. Volume and Surface area of solids are obtained   3. Area of irregular figures are obtained   4. Areas and volumes are obtained using Pappus theorem |
| * 1. Apply Power Series | * 1. Power series are obtained using Taylor’s Theorem   2. Power series are obtained using McLaurin’s ‘s theorem |
| * 1. Apply Statistics | * 1. Mean, median, mode and Standard deviation are obtained from given data   2. Calculations are performed based on Laws of probability   3. Calculation involving ***probability distributions*,** mathematical expectation sampling distributions are performed   4. Sampling distribution methods are applied in data analysis   5. Calculations involving use of standard normal table, sampling distribution, T-distribution and Estimation are done   6. Confidence intervals are determined |
| * 1. Apply Numerical methods | * 1. Roots of polynomials are obtained using iterative ***numerical methods***   2. Interpolation and extrapolation is performed using numerical methods |
| * 1. Apply Vector theory | * 1. Vectors and scalar quantities are obtained in two and three dimensions   2. ***Operations*** on vectors are performed   3. Position of vectors is obtained   4. Resolution of vectors is done |
| * 1. Apply Matrix | * 1. Determinant and inverse of 3x3 matrix are obtained   2. Solutions of simultaneous equations are obtained   3. Calculation involving Eigen values and Eigen vectors are performed |

**RANGE**

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

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

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skills:

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

**Required knowledge**

The individual needs to demonstrate knowledge of:

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

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| * 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   1. Applied Trigonometry and hyperbolic functions 2. Applied complex numbers 3. Applied Calculus 4. Solved Ordinary differential equations 5. Carried out mensuration 6. Applied Power Series 7. Applied vectors 8. Applied numerical methods 9. Applied statistics |
| * 1. Resource Implications | The following resources should be provided:   * 1. Access to relevant workplace or appropriately simulated environment where assessment can take place   2. Measuring equipment   3. Materials relevant to the proposed activity or tasks |
| * 1. Methods of Assessment | Competency in this unit may be assessed through:   * 1. Direct Observation   2. Demonstration with Oral Questioning   3. Written tests |
| * 1. Context of Assessment | Competency may be assessed individually in the actual workplace 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/MPE/CC/03/6/A

**Unit description**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range.*** |
| --- | --- |
| 1. Determine forces in a system | * 1. Forces are defined and described   2. ***Forces theorems*** are described   3. Resultant of coplanar forces are determined. |
| 1. Demonstrate knowledge of moments | * 1. Moments are defined   2. Moments are calculated   3. Principles of moments are described   4. Couples are identified and applied in engineering systems. |
| 1. Understand friction principles | * 1. Laws of friction are identified   2. Limiting friction is calculated   3. Forces applied at an angle to a horizontal plane are calculated   4. Coefficient of friction is calculated   5. Advantages and disadvantages of friction are identified. |
| 1. Understand motions in engineering | * 1. Motion concepts are discussed   2. Laws of motion are identified   3. Motion calculations are performed   4. Displacement/time graphs are applied |
| 1. Describe work, energy and power | * 1. Work is calculated   2. Energy is calculated   3. Power calculations are performed |
| 1. Perform machine calculations | * 1. ***Problems on simple machines*** are solved   2. Problems on levers are solved   3. Laws of machines are identified |
| 1. Demonstrate gas principles | * 1. ***Gas laws*** are identified   2. Gas laws are applied in solving engineering problems   3. Uses of gases in engineering systems are identified |
| 1. Apply heat knowledge | * 1. Heat concepts are discussed   2. Working principle of heat is defined   3. Heat capacity is discussed   4. Heat problems are solved |
| 1. Apply density knowledge | * 1. ***Density terminology*** are discussed   2. Density measurements are carried out   3. Density problems are solved |
| 1. Apply pressure principles | * 1. Pressure concepts are discussed   2. Working principles of pressure is discussed   3. Pressure problems are solved   4. ***Pressure applications*** are identified |

**RANGE**

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

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

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skills:

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

**Required knowledge**

The individual needs to demonstrate knowledge of:

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

**EVIDENCE GUIDE**

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

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

**UNIT CODE:** ENG/OS/MPE/CC/04/6/A

**Unit description**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

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

**RANGE**

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

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

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skills:

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

**Required knowledge**

The individual needs to demonstrate knowledge of:

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

**EVIDENCE GUIDE**

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

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

## APPLY FLUID MECHANICS PRINCIPLES

**UNIT CODE:** ENG/OS/MPE/CC/05/6/A

**Unit description**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range.*** |
| --- | --- |
| 1. Understand flow of fluids | * 1. Flow rate in pipes is measured according to work requirements   2. Losses in pipes are determined according to work requirements   3. ***Causes of losses*** in pipes are determined according to work requirements   4. Flow losses equations are applied in problem solving according to prescribed fluid principles |
| 1. Demonstrate knowledge in viscous flow | * 1. Viscous flow between parallel surfaces are explained according to prescribed fluid principles   2. Viscous flow equations between parallel surfaces are derived and applied according to prescribed fluid principles   3. Viscous flow equations in circular pipes are derived and applied in problem solving according to prescribed fluid principles |
| 1. Perform dimensional analysis | * 1. Dimensional analysis is explained according to prescribed fluid principles   2. Principle of dimensional homogeneity is explained according to prescribed fluid principles   3. Fundamental dimensions are stated according to prescribed fluid principles   4. Dimensional units are defined according to prescribed fluid principles   5. ***Physical quantities*** are identified according to prescribed fluid principles   6. Dimensional analysis is applied in problem solving according to prescribed fluid principles |
| 1. Operate fluid pumps | * 1. ***Principle of operation*** of pumps is described according to prescribed fluid principles   2. Reciprocating pump equation is derivedaccording to prescribed fluid principles   3. Centrifugal pump equation is derivedaccording to prescribed fluid principles   4. Pump equations are applied in problem solving according to prescribed fluid principles |

**RANGE**

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

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

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skills:

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

**Required knowledge**

The individual needs to demonstrate knowledge of:

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

**EVIDENCE GUIDE**

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

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

**UNIT CODE:** ENG/OS/MPE/CC/06/6/A

**Unit Description:**

The learner will be introduced to performing material testing and metallurgical processes. It involves analyzing properties of engineering materials, performing extraction processes, producing iron materials, ceramics, composites and alloys, performing heat treatment, material testing and identifying corrosion and its prevention

**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 is 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 iron materials | 1. Perform ore smelting according to standard operating procedures. 2. ***Composition of iron*** is determined 3. Method of producing ***iron material*** is established 4. Refinement processes are identified based on iron material required |
| 1. Produce alloy materials | * 1. Materials in alloy formation are identified   2. Alloy formation process is identified based on alloy to be produced   3. Alloy tested based on alloy production requirement |
| 1. Produce non-ferrous materials | * 1. ***Non-ferrous materials*** are extracted according to SOP   2. Extracted non-ferrous material is smelted and purified as per the SOP   3. Non-ferrous material is tested according to SOP   4. Alloying elements for non-ferrous materials are identified   5. Alloy formation process is identified based on alloy to be produced   6. Alloys for non-ferrous material are tested based on production requirement |
| 1. Produce ceramics materials | * 1. Composition of ***ceramic materials*** is identified   2. Manufacturing process is identified   3. Ceramic materials are produced according to manufacturing processes   4. ***Finishing processes*** are identified |
| 1. Produce composite materials | * 1. Type of composite to be produced is identified   2. Elements involve in composite formation are identified   3. Formation process of composite to be produced is identified   4. Composite is tested as per composite production requirement |
| 1. Utilise ***other engineering materials*** | * 1. Identify and select engineering material according to production requirements.   2. Operation plan is developed according to engineering drawing.   3. Appropriate machine is set up according to manufacturer’s manual   4. Production parameters are set according to production requirement   5. Production is performed |
| 1. Perform heat treatment | * 1. Safety practices are observed according to OSHA 2007   2. ***Heat treatment processes*** are identified   3. Procedure in heat treatment processes   4. Heat treatment of metals are performed |
| 1. Perform material testing | * 1. Safety is observed in material testing procedures   2. ***Material testing methods*** are identified depending on material to be tested   3. Procedure of material testing is followed as per material testing method   4. Material testing results are tabulated, calculated and interpreted   5. Material testing equipment are taken care of and maintained. |
| 1. Prevent material corrosion | * 1. Safety is observed during corrosion prevention   2. ***Corrosion type*** is identified   3. Corrosive atmosphere is 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** |
| --- | --- |
| * Mechanical properties may include but not limited to: | * Ductility * Malleability * Elasticity * Toughness * Hardness * Brittleness * Plasticity * Strength |
| * Physical properties may include but not limited to: | * Density * Color * Texture * Melting point * Thermo conductivity * Electrical resistivity |
| * Composition of iron may include but not limited to: | * + Iron (II) oxide   + Iron (III) oxide |
| * Iron materials may include but not limited to: | * + Cast iron   + Steel |
| * Ceramic materials may include but not limited to: | * + Oxides   + Nitrides   + Carbides   + Silica |
| * Finishing processes may include but not limited to: | * + Lapping   + Fine grinding   + Polishing |
| * Corrosion type may include but not limited to: | * + Galvanic   + Stress corrosion cracking |
| * Methods of corrosion prevention may include 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 engineering materials   3. Performed extraction processes   4. Produced iron materials   5. Produced ceramics   6. Produced composites   7. Produced alloys   8. Performed heat treatment   9. Performed material testing   10. Demonstrated understanding of corrosion types and its 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. The behaviour of the learner in the working environment   2. Inpection of finished product   3. Process analysis |
| 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. |

# CORE UNITS OF COMPETENCY

## DESIGN PRODUCTION PLANT

**UNIT CODE:** ENG/OS/MPE/CR/01/6/A

**Unit description**

This unit describes the competencies required by a technician to design production plant. It involves competencies required to carry out plant assessment needs, identify plant plan, develop multiple plant models, select plant model, simulate developed plant model, document developed plant design and follow up on design implementation and improvements

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT** | **PERFORMANCE CRITERIA**  ***(Bold and italicized terms are elaborated in the Range)*** |
| --- | --- |
| 1. Carry out plant assessment needs | * 1. Customer needs are identified through questionnaires and direct interviews according Standard Operating Procedures (SOPs)   2. Needs are analysed according to SOPs   3. Viable needs are selected from gathered data according to SOPs   4. Requirement for the selected needs are defined and analysed according to SOPs   5. Analysed data is documented according to organizational policy and legal requirements |
| 1. Identify plant plan | * 1. ***Production layouts*** are identified according to expected production   2. Goods to be produced or provided respectively are identified according to work requirements   3. Safety precautions and procedures are observed in plant plan according to work health and safety regulations and legislations   4. Loading and off-loading sections are identified according production requirements   5. Storage sections for both raw materials and finished products are identified and planned according to work requirements   6. By products storage and disposal section is planned according to goods to be produced   7. Plant plan is identified according to expected production. |
| 1. Develop multiple plant models | * 1. ***Plant parameters*** are identified according to expected plant output   2. Plant parameters are analysed according to expected output   3. Multiple plant plan ideas are generated according to plant specifications |
| 1. Select plant model | * 1. Models are analysed according to performance expectation   2. Best working solution model is selected according to analysed data   3. Document selected model solution according to SOPs |
| 1. Simulate developed plant model | 1. ***Modelling requirements*** are obtained according to the requirement. 2. Model is developed according to design requirements 3. Developed model is simulated/tested according to design requirements 4. Data is collected according to SOPs 5. Model is redesigned if needs be according to user needs. |
| 1. Document developed plant design | * 1. Collected data is documented according to SOPs   2. ***Technical report*** is developed according to the model design   3. Operation manual is developed according to product design   4. The product design is patented according to Industrial Property Act,2001 |
| 1. Follow up on design implementation and improvements | * 1. Feedback is gathered according to design performance   2. Design performance is evaluated according to gathered data   3. Report is generated according to design performance   4. Amendments and improvements are made on design and documented according to performance |

**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** |
| --- | --- |
| * Plant parameters may include but not limited to: | * Production rate * Products quality * Products size |
| * Modelling requirements may include but not limited to: | * Software * Materials * Tools * Workspace |
| * Technical report may include but not limited to: | * Data sheet * Design drawings * Design calculations * Power specifications * Variables and constants * Notes |
| * Production layouts may include but not limited to: | * Product/line * Process/functional * Fixed position * Combination type |

**REQUIRED KNOWLEDGE**

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

* Mechanical fasteners
* Technical drawing
* Inspection techniques
* Tools and equipment
* Evaluation
* Problem solving
* Interpretation of technical drawings
* Documentation
* Computer Aided Design
* Plant plans
* Plant layouts
* Simulation
* Data gathering and analysis

**REQUIRED SKILLS**

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

* Communication skills
* Problem solving
* Creativity and innovation
* Data collection and analysis
* Use of tools and equipment
* Technical presentation
* Technical drawing
* Operation Monitoring
* Model development

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency. | * 1. Carried out plant assessment needs   2. Identified plant plans   3. Developed multiple plant models   4. Selected plant model   5. Simulated developed plant models   6. Documented developed plant design   7. Followed up on design implementation and improvements   8. Identified plant plan.   9. Identified plant parameters output   10. Developed plant model   11. Generated technical report |
| 1. Resource Implications. | * 1. Computers   2. Software   3. Projectors   4. Whiteboards   5. Tools and equipment   6. Models   7. Whiteboards markers |
| 1. Methods of Assessment. | ***Competency may be assessed through:***   * 1. Practical   2. Observation   3. Questionnaire   4. Case studies   5. Written examinations   6. Oral presentation |
| 1. Context of Assessment. | Competency may be assessed individually in an actual workplace or in work-simulated conditions within accredited institutions. |
| 1. Guidance information for assessment. | This unit may be assessed on an integrated basis with others within this occupational sector. |

## INSTALL MECHANICAL PLANT MACHINERY

**UNIT CODE:** ENG/OS/MPE/CR/02/6/A

**Unit description**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

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

**RANGE**

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

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

**REQUIRED KNOWLEDGE**

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

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

**REQUIRED SKILLS**

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

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

**EVIDENCE GUIDE**

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

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

## PERFORM PLANT MAINTENANCE

**UNIT CODE:** ENG/OS/MPE/CR/03/6/A

**Unit description**

This unit describes the competencies required by a technician to perform plant maintenance. It involves competencies required to inspect production plant, identify maintenance needs, plan and prepare for plant operational maintenance, conduct breakdown maintenance, conduct preventive maintenance, conduct corrective maintenance, test and commission where applicable and document maintenance work done

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT** | **PERFORMANCE CRITERIA**  ***(Bold and italicized terms are elaborated in the Range)*** |
| --- | --- |
| 1. Inspect production plant | * 1. Work safety is observed and adhered to according to health and safety legislation and regulations   2. Inspection checklist is developed according to machine specifications   3. Correct specification for the production plant being inspected is followed according to plant manual   4. Correct equipment to carry out the inspection is used according to inspection manual   5. Inspection checks to be made and acceptance criteria to be used is identified and confirmed according to plant requirements   6. All required inspections as specified are carried out according to plant requirements   7. Any defects or variations from the specification are identified and rectified if possible according to plant requirements   8. Results of the inspection are recorded according to SOPs |
| 1. Identify maintenance needs | * 1. Work safety is observed and adhered to according to health and safety legislation and regulations   2. ***Maintenance types*** are defined according inspection results.   3. Maintenance manuals are analysed according to work requirements   4. ***Components*** to be maintained are identified according to system requirements |
| 1. Plan and prepare for plant maintenance | * 1. Health and safety precautions are observed according to OSHA   2. Maintenance records are checked and analysed according to work requirements   3. Work plan is developed according to work requirements.   4. Clear priority rules are set according to work requirements   5. Tools and equipment are identified and checked to be in usable conditions according to manufacturer’s manual.   6. Consumables, spare parts and materials availability is checked according to work requirements.   7. Availability of required labour is checked according to work requirement. |
| 1. Conduct breakdown maintenance | * 1. Work safety is observed and adhered to according to health and safety legislation and regulations   2. Machine is switched off from power supply according to user manual.   3. Appropriate signage is placed on both control and operation panel according to organization procedures.   4. Machine is inspected according to work requirements   5. Identified faulty assemblies are dismantled and marked for identification according to maintenance manual parts are lubricated according to manufacturer’s recommendation   6. Maintained machine is tested according to manufacturer’s manual   7. Maintenance records are updated according to SOPs   8. Machine is handed over according to existing organizational policy. |
| 1. Conduct preventive maintenance | * 1. Work safety is observed and adhered to according to health and safety legislation and regulations   2. All people affected by required preventive maintenance and their impact are notified according to organisational procedures   3. Equipment is checked to be correctly set up for preventive maintenance according to maintenance manual   4. Relevant data from technical or supporting manuals is accessed to assist with preventive maintenance according to organisation’s regulations   5. Lubrication status of moving parts of the machine is done according to maintenance procedures   6. Cleaning of components is carried out according to maintenance procedures   7. Components are repainted according to maintenance manual   8. Preventive maintenance of all components is performed according to maintenance schedule/protocol   9. Instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule are reported according to organisation’s regulations   10. Equipment is checked for functioning against expected operational parameters to confirm operational status according to operational manual   11. Waste materials are disposed in accordance with safe working practices and approved procedures   12. Relevant maintenance records are completed according to SOPs   13. Machine is handed over according to existing organizational policy. |
| 1. Conduct corrective maintenance | * 1. Work safety is observed and adhered to according to health and safety legislation and regulations   2. All people affected by required corrective maintenance and their impact are notified according to organisational procedures   3. Equipment is checked to be correctly set up for corrective maintenance according to maintenance manual   4. Relevant data from technical or supporting manuals is accessed to assist with corrective maintenance according to organisation’s regulations   5. Fault diagnosis and identification is carried out according to work requirements   6. Corrective maintenance of fault is performed according to maintenance schedule/protocol   7. Waste materials are disposed in accordance with safe working practices and approved procedures   8. Relevant maintenance records are completed according to SOPs.   9. Machine is handed over according to existing organizational policy. |
| 1. Train plant operators | * 1. Training needs are identified according to work requirements/machines.   2. Training materials are prepared according to training specifications   3. Training is planned and scheduled according to organizational procedures.   4. Operators are trained according to organizational procedures.   5. Training follow ups are made from time to time according to organizational procedures. |
| 1. Test and commission where applicable | * 1. Health and safety precautions are observed according to OSHA   2. Relevant testing tools and equipment are identified according to system manuals   3. Plant machine/equipment is tested and rectified where applicable according to system functionality specifications   4. Calibration of parameters is done to achieve the desired results according to expected output   5. Commissioning of the machine is done as per the system manuals |
| 1. Document maintenance work done | * 1. Technical report is developed according to the maintenance procedures   2. Maintenance adjustments are documented according to SOPs   3. Unmet maintenance activities are documented according to SOPs   4. File maintenance documents according to organizational policy. |

**RANGE**

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

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

**REQUIRED KNOWLEDGE**

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

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

**REQUIRED SKILLS**

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

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

**EVIDENCE GUIDE**

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

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

## MAINTAIN HYDRAULIC AND PNEUMATIC SYSTEMS

**UNIT CODE:** ENG/OS/MPE/CR/04/6/A

**Unit description**

This unit covers the competencies required to maintain hydraulic and pneumatic systems. It involves competencies to observe occupational health and safety, troubleshooting hydraulic and pneumatic systems, identifying and obtaining spare parts, repairing hydraulic and pneumatic systems, testing and commissioning hydraulic and pneumatic systems and recording and generating maintenance report.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT** | **PERFORMANCE CRITERIA**  ***(Bold and italicized terms are elaborated in the Range)*** |
| --- | --- |
| 1. Observe occupational health and safety | * 1. ***Personal protective equipment*** (PPE) are used according to OSHA 2007   2. ***Tools and equipment*** are stored and maintained correctly according to manufacturer’s specifications   3. Tools and equipment are used correctly according to designated purpose   4. Workspace housekeeping is maintained according to Standard operating procedures (SOPs)   5. Workplace is planned according to design specifications.   6. Safety signs are placed and observed according to OSHA 2007 |
| 1. Troubleshoot hydraulic and pneumatic systems | * 1. Proper authorization is obtained according to statutory policy   2. System manual is interpreted according to system requirements   3. Tools and equipment are identified according to system requirements   4. System fault is identified and ***classified*** according to recommended steps/procedures in the service manual |
| 1. Identify and obtain spare parts | * 1. System manuals and other relevant ***documents and publications*** are analysed according system design   2. Spare part inspection is done according to work specification   3. Parts vendors are contacted according to organisation’s purchasing requirements   4. Spare parts are purchased according to organisation’s purchasing regulations   5. Spare parts are received and verified according to system requirements |
| 1. Repair hydraulic and pneumatic systems | * 1. Service manual is analysed according to work requirements   2. Tools and equipment are selected and checked to be in usable condition according to user manual   3. System is switched off where applicable according to safety standards.   4. Components are repaired according to the service manual and specifications   5. Defects are rectified in accordance with manufacturer’s procedure.   6. System repairs are documented according to SOPs |
| 1. Test and commission hydraulic and pneumatic systems | * 1. ***Peripheral devices*** are verified if they are properly connected according to system manual   2. Peripheral devices functionality is verified according to system manual   3. Oil ***validity*** is verified according prescribed system requirements   4. Fluid leakages are checked according to prescribed oil leakage checking methods   5. ***Testing equipment*** are selected and operated correctly according to manufacturer’s specifications   6. Oil flow is tested according to design specifications   7. Instruments and controllers are tested according to system requirements |
| 1. Record and generate maintenance report | * 1. Technical report is developed according to the maintenance procedures   2. Maintenance adjustments are documented according to SOPs   3. Unmet maintenance activities are documented according to SOPs |

**RANGE**

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

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

**REQUIRED KNOWLEDGE**

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

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

**REQUIRED SKILLS**

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

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

**EVIDENCE GUIDE**

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

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

## OPERATE PLANT MACHINES/UTILITIES

**UNIT CODE:** ENG/OS/MPE/CR/05/6/A

**Unit description**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT** | **PERFORMANCE CRITERIA**  ***(Bold and italicized terms are elaborated in the Range)*** |
| --- | --- |
| 1. Observe occupational health and safety | * 1. ***Personal protective equipment*** (PPE) are used according to OSHA 2007   2. Tools and equipment are stored and maintained correctly according to manufacturer’s specifications   3. ***Tools and equipment*** are used correctly according to designated purpose   4. Workspace housekeeping is maintained according to Standard operating procedures (SOPs)   5. Workplace is planned according to design specifications.   6. Safety signs are placed and observed according to OSHA 2007 |
| 1. Handle raw materials | * 1. Work safety is observed and adhered to according to health and safety legislation and regulations.   2. Unwanted materials/objects are removed from delivered raw materials as prescribed in health and safety regulations   3. Raw materials are requested internally where applicable according to organizational policy   4. Raw materials are transferred to storage areas as prescribed in organisation’s regulations   5. Material handling machinery is inspected according to manuals   6. Material handling machinery is operated according to user manual   7. Hazardous materials are handled with caution as prescribed in handling manual |
| 1. Set machine parameters | * 1. Machine safety functions are established as per manufacturer’s specification.   2. Raw materials are identified according to production requirements   3. Finished product is identified as per customer requirement   4. Machine parameters are set according to product requirement. |
| 1. Operate plant machine | * 1. Work safety is observed and adhered to according to health and safety legislation and regulations   2. Plant machines are visually inspected according to workplace policy   3. Machinery is switched on as prescribed in user manual   4. ***Lifting equipment*** operated according to operation manual and work specification   5. Links, joints and other protruding parts go back to their resting position as per manufacturer’s requirements.   6. Machinery is switched off according to user manual |
| 1. Control product quality | * 1. Production manual is analysed according to work requirements   2. ***Production parameters*** are set as prescribed in product manual   3. Products are produced according to work requirements   4. Products are inspected against set parameters as prescribed in production manual   5. Defective products are isolated as per production manual |
| 1. Carry out autonomous maintenance | * 1. Work safety is observed and adhered to according to health and safety legislation and regulations   2. Approval for use of the appropriate spare is obtained according to organisation’s regulations   3. Autonomous Maintenance is carried out according to work requirements   4. Overall Equipment Effectiveness (OEE) measure and information to determine which elements of the OEE and their associated losses need improvement is used according to organisation’s prescribed regulations   5. Action plan that will reduce/eliminate the losses and hence improve the Overall Equipment Effectiveness is used according to maintenance procedures   6. Improvements to working practices through Autonomous Maintenance are implemented according to maintenance procedures |
| 1. Record and generate production reports | * 1. Information and data to be reported is identified according to production requirements   2. Method of recording information and data is identified in accordance with company procedures   3. Production information and data is recorded according to company procedures   4. Production reports are generated in accordance with company procedures   5. Records are processed and stored in accordance with company procedures |
| 1. Store finished products. | * 1. Finished products are recorded in appropriate documents according to company procedures   2. Storage section is kept clean in accordance with health and safety regulations   3. Finished products are stored in special conditions as prescribed in health and safety regulations and nature of products.   4. Other materials and finished products are stored in accordance with health and safety regulations |

**RANGE**

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

| **Variable** | **Range** |
| --- | --- |
| * Tools and equipment may include but not limited to: | * Hand tools * Power tools * Machines |
| * Personal protective equipment may include but not limited to: | * Goggles * Ear muff * Safety mask * Helmets/head gear * Safety boots * Gloves * Overall/dust coat |
| * Product parameters may include but not limited to: | * Size * Production time * Colour * Texture |

**REQUIRED KNOWLEDGE**

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

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

**REQUIRED SKILLS**

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

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

**EVIDENCE GUIDE**

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

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

## OPTIMISE PRODUCTION SYSTEMS

**UNIT CODE:** ENG/OS/MPE/CR/06/6/A

**Unit description**

This unit describes the competencies required to optimize production systems. It involves competencies required to identify process/ system for review, collect and analyze system/process data, develop system/process tests or trials, develop system/process improvement solution and record and generate production reports

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT** | **PERFORMANCE CRITERIA**  ***(Bold and italicized terms are elaborated in the Range)*** |
| --- | --- |
| 1. Identify process/ system for review | * 1. Review process or ***plant performance*** to determine likely areas of improvement.   2. Gather data on the process or system design according to workplace setup   3. Design the data collection system for the required data according to organization policy. |
| 1. Collect and analyze system/process data. | * 1. Collect or review available data from the process or plant according to nature of the plant   2. Analyse the data for trends or dependencies   3. Postulate possible cause and effect scenarios |
| 1. Develop system/process tests or trials. | * 1. Propose controlled tests or trials to review the plant or process patterns   2. Discuss possible solutions to cause with relevant people as per workplace procedures   3. Arrange for required tests or controls to be undertaken in appropriate time frame   4. Collect further data from tests or trials   5. Review plant or process data and compare with original data.   6. Prepare further tests or trials as required, or until possible solutions are developed. |
| 1. Develop system/process improvement solution | * 1. Agree required improvement solution with appropriate people   2. Arrange for required improvement solution to be undertaken in appropriate time frame   3. Follow items initiated through until final resolution has occurred   4. Check effectiveness of solution and take appropriate action. |
| 1. Record and generate production reports | * 1. Information and data to be reported is identified according to production requirements   2. ***Method of recording information and data*** is identified in accordance with company procedures   3. Production information and data is recorded according to company procedures   4. Production reports are generated in accordance with company procedures   5. Records are processed and stored in accordance with company 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** |
| --- | --- |
| * Plant performance may include but not limited to: | * Outputs * Parameters * Cost of production * Downtime |
| * Method of recording information and data may include but not limited to: | * Camera/video * Recording * Note * Testing |

**REQUIRED KNOWLEDGE**

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

* Plant equipment, its characteristics and limitations
* Impact of variations in plant/process and the distinctive signs of each variation
* Process chemistry, physics and biochemistry as relevant (e.g. to the extent of writing chemical equations and identifying factors controlling reaction rate and yield or equivalent, or determining mass or heat transfer rates for a process)
* Problem isolation techniques
* Problem analysis techniques
* Organisation approval processes

**REQUIRED SKILLS**

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

* Problem solving
* Data collection and analysis
* Total Productive Maintenance
* Overall Equipment Effectiveness (OEE)
* Fault diagnosis
* Attention to details
* Data collection and analysis
* Problem solving for multi-variable processes
* Negotiation
* Communication
* Basic mathematics

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency. | * 1. Identified process/ system for review   2. Collected and analyzed system/process data   3. Developed system/process tests or trials.   4. Developed system/process improvement solution   5. Recorded and generated production reports |
| 1. Resource Implications. | * 1. Computers   2. Software   3. Tools and equipment+5   4. Whiteboards   5. Whiteboard markers   6. Manuals |
| 1. Methods of Assessment. | ***Competency may be assessed through:***   * 1. Practical   2. Observation   3. Questionnaire   4. Case studies   5. Written examinations   6. Oral presentation |
| 1. Context of Assessment. | Competency may be assessed individually in an actual workplace or in work-simulated conditions within accredited institutions. |
| 1. Guidance information for assessment. | This unit may be assessed on an integrated basis with others within this occupational sector. |

## APPLY KAIZEN PRINCIPLES

**UNIT CODE:** ENG/OS/MPE/CR/07/6

**Unit description**

This unit covers the competencies required to apply kaizen principles. It involves competencies to document current processes, identify and capture critical process, analyze current processes, design new processes, evaluate and select among alternatives, develop business case for action, obtain approval for implementing change, plan for improvement process and maintain competitive advantage through continuous process improvement.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT** | **PERFORMANCE CRITERIA**  ***(Bold and italicized terms are elaborated in the Range)*** |
| --- | --- |
| 1. Document current processes | * 1. Production process is identified and defined according to organisation’s activities   2. Process boundaries are outlined according to organisation’s activities   3. Process inputs are identified according to organisation’s activities   4. Process outputs are identified according to organisation’s activities   5. Identified process details are documented according to organisation’s policy. |
| 1. Identify and capture critical process | * 1. Production process stages are outlined according to organisation’s activities   2. Production process stages are arranged in order in accordance with production activities   3. Information on process stages is gathered according to organisation’s activities   4. Critical process is identified in accordance with production activities |
| 1. Analyze current processes | * 1. Process stage individuals are interviewed in accordance with production process   2. A process flowchart is produced according to organisation’s activities   3. Exceptions to normal process flow are noted according to organisation’s activities   4. Risks in process are identified according to organisation’s activities   5. Areas of ***improvement*** within work activities are identified according to organisation’s activities |
| 1. Design new processes where applicable | * 1. Existing processes are re-examined as per the existing problem   2. Gathered information is analysed according to SOPs   3. Multiple process ideas are generated according to problem specifications |
| 1. Evaluate and select among alternatives | * 1. Processes are analysed according to organisation’s activities   2. ***Process parameters*** in different process designs are analysed according to organisation’s activities   3. Best working process design is selected according to analysed data   4. Document selected process design according to SOPs |
| 1. Develop business case for action | * 1. Designed process is described outlining how it will solve the current problem according to organisation’s activities   2. Costs and benefits analysis is undertaken in accordance with project expectations   3. Implementation plan of design process is generated accordance with project expectations   4. Process design summary is produced accordance with project expectations |
| 1. Obtain approval for implementing change | * 1. Business case is presented to management according to organisation’s regulations   2. Proposals from management are incorporated according to organisation’s requirements   3. Business case for action is re-presented to management according organisation’s policy   4. Approval for implementation is given according to organisation’s policy |
| 1. Plan for improvement process | * 1. Materials are obtained according to work specifications   2. Tools and equipment are availed according to work specifications   3. Process improvements are implemented according to project expectations   4. New process is tested and commissioned according to organisation’s policy   5. Design is documented according to SOPs |
| 1. Maintain competitive advantage through continuous process improvement. | * 1. Measures of performance are determined and calculated according to process requirements   2. Optimum resources required for the process calculated according to process requirements   3. Key performance indicators are used to ensure better performance of the process |

**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** |
| --- | --- |
| * Process parameters may include but not limited to: | * Production time * Quality |
| * Measures of performance may include but not limited to: | * Quality * Cost * Delivery |
| * Improvement may include but not limited to: | * Reduction in cost * Improved health and safety and/or working environment * Improved quality * Improved regulatory compliance * Improvements to working practices * Reduction in lead time * Reduction in waste and/or energy usage * Improved customer service * Improved resource utilisation |

**REQUIRED KNOWLEDGE**

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

* Waste in production and their elimination
* Problem solving
* Analysis
* Deming cycle
* quantifiable targets and objectives
* business' key measures of competitiveness

**REQUIRED SKILLS**

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

* Communication skills
* Problem solving
* Creativity and innovation
* Data collection and analysis
* Use of tools and equipment
* Technical presentation
* Technical drawing

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency. | * 1. Documented current processes   2. Identified and captured critical process   3. Analyzed current processes   4. Designed new processes   5. Evaluated and selected among alternatives   6. Developed business case for action   7. Obtained approval for implementing change   8. Planned for improvement process   9. Maintained competitive advantage through continuous process improvement. |
| 1. Resource Implications. | * 1. Computers   2. Software   3. Projectors   4. Markers   5. Whiteboards   6. Tools and equipment   7. Whiteboard markers |
| 1. Methods of Assessment. | ***Competency may be assessed through:***   * 1. Practical   2. Observation   3. Questionnaire   4. Written examinations   5. Oral presentation |
| 1. Context of Assessment. | Competency may be assessed individually in an actual workplace or in work-simulated conditions within accredited institutions. |
| 1. Guidance information for assessment. | This unit may be assessed on an integrated basis with others within this occupational sector. |

## MANAGE SPARES AND CONSUMABLES INVENTORY

**UNIT CODE:** ENG/OS/MPE/CR/08/6/A

**Unit description**

This unit describes the competencies required by a technician to manage spares and consumables inventory. It involves competencies to observe occupational health and safety, identify critical spares and consumables, procure spares and consumables, inspect ordered spares and consumables, store received spares/consumables, carry out stock taking, manage store human resource and record and generate inventory report

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT** | **PERFORMANCE CRITERIA**  ***(Bold and italicized terms are elaborated in the Range)*** |
| --- | --- |
| 1. Observe occupational health and safety | * 1. ***Personal protective equipment*** (PPE) and ***firefighting equipment*** are used according to OSHA 2007   2. Tools and equipment are stored and maintained correctly according to manufacturer’s specifications   3. ***Tools and equipment*** are used correctly according to designated purpose   4. Workspace housekeeping is maintained according to Standard operating procedures (SOPs)   5. Safety signs are placed and observed according to OSHA 2007 |
| 1. Identify critical spares and consumables | * 1. Analysis of maintainable spares, materials and consumables is conducted according to company policy   2. Impact of equipment failure is determined according to company activities   3. General spares are determined and critical spares selected according to plant requirement   4. Spares and consumables availability is confirmed from the supplier as per demand. |
| 1. Purchase requisition for spares and consumables | * 1. Organisational procedures, legal and ethical requirement are complied with according to organisation’s and state requirements   2. Procurement personnel is consulted according organisation’s procedures   3. Spares and consumables are sourced according organisation’s procedures   4. Spares and consumables which offer optimal mix are selected according organisation’s procedures   5. Negotiation with suppliers is initiated according to product specifications   6. Products are procured according organisation’s procedures. |
| 1. Inspect ordered spares and consumables | * 1. Purchase order documents of the products are analysed as per organisation’s policy   2. Delivery documents are analysed and certified as per the ordered products   3. Procured products are counted and confirmed according to purchasing order   4. Packaging information on individual products is checked according to the ordered products |
| 1. Store received spares/consumables | * 1. Received spares/consumables are labelled and tagged according to organisation’s regulations   2. Bin cards are generated according to organization’s policy.   3. Goods received note is raised as per company policy.   4. Storage location is cleaned according to health and safety regulations   5. Products are recorded according to company procedures.   6. Storage conditions are kept as prescribed in storage manual   7. Hazardous and fragile products are stored in special conditions as prescribed in health and safety regulations   8. Other materials and finished products are stored in accordance with health and safety regulations |
| 1. Issue spares and consumables | * 1. Requisition from the user is obtained/received according to organizational procedures.   2. Spare/consumable to issued is identified according to store setup   3. Spare/consumables is issued according to store procedures.   4. Records are updated according to organizational procedures. |
| 1. Carry out stock taking | * 1. Stock is counted and confirmed to verify available physical quantities according to organisation’s requirements   2. ***Labelling/tagging information*** on products is checked according to products catalogue   3. Stock date is tagged on products according to organizational procedures.   4. Requirements to replenish stock is recorded according to organisation’s requirements   5. Damaged spares and consumables are disposed according to organizational policy and safety regulations.   6. Stock records are updated according to organisation’s policy |
| 1. Manage store staff | * 1. Personnel are hired according to organisation’s requirements   2. Personnel are supervised according to store activities   3. Store duties are delegated according to work requirements   4. Staff members are appraised according to work performance   5. Personnel duty roster is maintained according to store activities |
| 1. Record and generate inventory report | * 1. Reorder level reports are generated according to organizational policy.   2. Daily inventory information is recorded according to organisation’s requirements   3. Daily inventory is compiled to generate monthly report according to SOPs   4. Annual report is generated according to SOPs   5. Inventory and reports are maintained according to organizational policies. |

**RANGE**

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

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

**REQUIRED KNOWLEDGE**

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

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

**REQUIRED SKILLS**

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

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

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency. | * 1. Observed occupational health and safety   2. Identified critical spares and consumables   3. Procured spares and consumables   4. Inspected ordered spares and consumables   5. Stored received spares/consumables   6. Carried out stock taking   7. Managed store human resource   8. Recorded and generated inventory report |
| 1. Resource Implications. | * 1. Computers   2. Software   3. Whiteboards   4. Whiteboard markers   5. Manuals |
| 1. Methods of Assessment. | ***Competency may be assessed through:***   * 1. Practical   2. Observation   3. Questionnaire   4. Written examinations   5. Oral presentation |
| 1. Context of Assessment. | Competency may be assessed individually in an actual workplace or in work-simulated conditions within accredited institutions. |
| 1. Guidance information for assessment. | This unit may be assessed on an integrated basis with others within this occupational sector. |

## PERFORM WORKSHOP PROCESSES

**UNIT CODE:** ENG/OS/MPE/CR/09/6/A

**Unit description**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

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

**RANGE**

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

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

**REQUIRED KNOWLEDGE**

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

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

**REQUIRED SKILLS**

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

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

**EVIDENCE GUIDE**

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

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

## MANAGE PRODUCTION PLANT PROCESS

**UNIT CODE:** ENG/OS/MPE/CR/10/6/A

**Unit description**

This unit describes the competencies required by a technician to manage production plant process. It involves competencies required to set up production process, operationalize production process, maintain production targets, control stock utilization, oversee plant maintenance, maintain production records, manage storage of raw materials and production outputs, manage production rejects and manage safety operations

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT** | **PERFORMANCE CRITERIA**  ***(Bold and italicized terms are elaborated in the Range)*** |
| --- | --- |
| * Set up production process | 1. Item to be produced is identified according to work requirements. 2. Raw materials for production are checked according to production requirement. 3. Production machine is inspected according to manufacturer’s specifications. 4. Labour availability is confirmed according to job requirements. 5. Production lines are inspected according to installation manual 6. Safety devices are checked according to health and safety regulations 7. Work area is set and cleaned according to safety regulations 8. Production line is tested according to operation manual |
| * Operationalize production process | * 1. Production line settings are adjusted according required standards   2. Production line is run according to operation manual   3. Products are checked against expected standards   4. Faults are identified and rectified according to operational and quality procedures   5. Finished products are packed and arranged according to prescribed procedures   6. Rejects are removed and secured according to health and safety guidelines |
| * Maintain production targets | * 1. Production targets are set according to production requirements   2. Production personnel is informed of the set targets according to production requirements   3. Set targets are assigned to production personnel at each process stage according to production requirements   4. Follow up of set targets is made according to production requirements   5. Achieved targets are reviewed according to production requirements.   6. Production targets are assessed to ascertain if objectives have been met according to production plans.   7. Records of production targets are maintained according to production requirements |
| * Control raw materials utilization | * 1. Raw materials requirements are defined according to production needs.   2. Raw materials are re-ordered to replenish depleting stock according to company policies   3. Raw materials records are maintained according to SOPs |
| * Coordinate plant maintenance | * 1. Plant machineries are inspected regularly according to company regulations   2. ***Various maintenance*** schedules are planned according to company requirements   3. Production machines are availed for maintenance according to production plans.   4. Maintenance records are maintained according to SOPs |
| * Maintain production records | * 1. Information and data to be reported is identified according to production requirements   2. Method of recording information and data is identified in accordance with company procedures   3. Production information and data is recorded according to company procedures   4. Production reports are generated in accordance with company procedures   5. Records are processed and stored in accordance with company procedures |
| * Manage storage of raw materials and production outputs | * 1. Storage section is kept clean in accordance with health and safety regulations   2. Storage conditions are kept as prescribed in storage manual   3. Hazardous and fragile raw materials and finished products are stored in special conditions as prescribed in health and safety regulations   4. Storage are updated according to SOPs   5. Stored raw material and finished goods are inspected regularly according to organisation’s regulations |
| * Manage production rejects | * 1. Plant machinery is maintained according to maintenance manual   2. Production staff is trained according to work requirements   3. Production parameters are set according to production requirements   4. Finished products are inspected according to production requirements   5. Rejects are isolated according to company policies |
| * Manage safety operations | * 1. Personal protective equipment is provided all the time according to health and safety regulations   2. Daily safety inspections are made according to health and safety regulations   3. Safety precaution notices and posts are placed at strategic points according to health and safety regulations   4. 5S’s is implemented according to set down procedures.   5. Personnel feedback on safety issues is acted on according to health and safety regulations   6. Safety goals are set according to organisation’s requirements   7. First aid operations are handled according to health and safety regulations   8. Plant inspection reports are reviewed according to safety and health regulations |
| * Manage sectional staff | * 1. Leave rota is developed and planned according to organization procedures.   2. Jobs are allocated according to available job and experience.   3. Set time schedules are complied with in accordance with organizational regulations.   4. Disputes are resolved amicably as per organizational policies   5. Staff appraisal is conducted in accordance with organizational procedures |

**RANGE**

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

| **Variable** | **Range** |
| --- | --- |
| Tools and equipment may include but not limited to: | * Hand tools * Power tools |
| Types of maintenance may include but not limited to: | * Preventive maintenance * Corrective maintenance * Predictive maintenance |

**REQUIRED KNOWLEDGE**

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

* Documentation
* Scheduling/planning for maintenance
* Service and repair of machinery
* Technical report writing
* Data analysis and interpretation
* Safety and hazards
* Problem solving
* Quality assurance
* Quality control
* Faults in production

**REQUIRED SKILLS**

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

* Machine operation
* Communication skills
* Problem solving
* Data collection and analysis
* Service and repair of system components
* Fault diagnosis
* Attention to details

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency. | * 1. Set up production process   2. Operationalized production process   3. Maintained production targets   4. Controlled stock utilization   5. Oversaw plant maintenance   6. Maintained production records   7. Managed storage of raw materials and production outputs   8. Managed production rejects   9. Managed safety operations |
| 1. Resource Implications. | * 1. Computers   2. Whiteboards   3. Whiteboard markers   4. Manuals |
| 1. Methods of Assessment. | ***Competency may be assessed through:***   * 1. Practical   2. Observation   3. Questionnaire   4. Case studies   5. Written examinations   6. Oral presentation |
| 1. Context of Assessment. | Competency may be assessed individually in an actual workplace or in work-simulated conditions within accredited institutions. |
| 1. Guidance information for assessment. | This unit may be assessed on an integrated basis with others within this occupational sector. |