

**REPUBLIC OF KENYA**

**NATIONAL OCCUPATIONAL STANDARDS**

**FOR**

**MECHANICAL TECHNICIAN**

**LEVEL 6**



TVET CDACC

P.O BOX 15745-00100

NAIROB

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**Council Secretary/CEO**

**TVET Curriculum Development, Assessment and Certification Council**

**P.O. Box 15745–00100 Nairobi, Kenya**

**Email: cdacc.tvet@gmail.com**

# FOREWORD

The provision of quality education and training is fundamental to the

Government‟s overall strategy for social economic development. Quality education and training will contribute to achievement of Kenya‟s development blue print and sustainable development goals.

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

These reforms demand that Industry takes a leading role in curriculum development to ensure the curriculum addresses its competence needs. It is against this background that these Occupational Standards were developed for the purpose of developing a competency based curriculum for Mechanical Production Technician Level 6. These Occupational Standards will also be the bases for assessment of an individual for competence certification.

It is my conviction that these Occupational Standards will play a great role towards development of competent human resource for the Mechanical

Engineering sector’s growth and sustainable development.

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

# PREFACE

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

The Technical and Vocational Education and Training Act No. 29 of 2013 and the 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 shift to CBET to address the mismatch between skills acquired through training and skills needed by industry as well as increase the global competitiveness of Kenyan labor force.

The TVET Curriculum Development, Assessment and Certification Council (TVET CDACC), in conjunction with Mechanical Engineering Sector Skills Advisory Committee (SSAC), have developed these Occupational Standards for a Mechanical Engineering Production Technician. These occupational standards will be the bases for development of competency based curriculum for Mechanical Engineering Production Technician Level 6. These Standards will also be the bases for assessment of an individual for competence certification.

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

I am grateful to the Council Members, Council Secretariat, 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**

# ACKNOWLEDGEMENT

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

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

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

**CHAIRPERSON, MECHANICAL ENGINEERING SSAC**

# ACRONYMNS

CBET Competency Based Education and Training

CDACC Curriculum Development Assessment and Certification Council

CUR Curriculum

DACUM Develop a Curriculum

EMCA Environmental Management and Conservation Act

KCSE Kenya Certificate of Secondary Education

KNQA Kenya National Qualifications Authority

MoEST Ministry of Education Science and Technology

NGO Non-Governmental Organization

NOS National Occupation Standard

OS Occupational Standard

OSHA Occupational Safety and Health Act

PPE Personal Protective Equipment

RPL Recognition of Prior Learning

SSAC Sector Skills Advisory Committee

TVETA Technical and Vocational Education and Training Authority

# KEY TO UNIT CODE

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

Industry or sector

Occupational Standards

Occupational area

Type of competency

Competency number

Competency level

Control Version

# OVERVIEW

Certified Mechanical Production Technician qualification consists of competencies that a person must achieve to enable him/her to Fabricate Sheet Metal Parts, Arc Welding, Bench Work, Hole Production, Lathe work, Surface Grinding and Hole production.

The units of competency comprising certified Mechanical Production Technician level VI qualification include the following basic and core competencies:

**BASIC COMPETENCIES**

1. Demonstrate communication skills
2. Demonstrate digital literacy
3. Demonstrate entrepreneurial skills
4. Demonstrate employability skills
5. Demonstrate environmental literacy
6. Demonstrate occupational safety and health practices

**COMMON COMPETENCIES**

1. Prepare and interpret technical drawings
2. Apply engineering mathematics
3. Apply mechanical science principles
4. Apply fluid mechanics principles
5. Apply thermodynamics principles
6. Apply material science and perform metallurgical processes

**CORE COMPETENCIES**

1. Produce parts by bench work
2. Lathe work
3. Sheet metal work
4. Join parts by manual metal arc welding
5. Milling work
6. Produce parts by grinding machine parts
7. Perform workshop processes
8. Manage mechanical workshop

# BASIC UNITS OF COMPETENCY

**DEMONSTRATE COMMUNICATION SKILLS**

**UNIT CODE: ENG/OS/ME/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.

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| 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/ME/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**

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| **ELEMENT**  These describe the key outcomes which make up workplace function | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 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.

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| **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/ME/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/ME/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/ME/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/ME/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**

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| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 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/AUT/CC/1/6/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**

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| --- | --- |
| **ELEMENT**  These describe the key outcomes which make the workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify therequired level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 1. Use and maintain drawing equipment and materials | 1.1 ***Drawing equipment*** are identified and gathered according to task requirements  1.2 ***Drawing materials*** are identified and gathered according to task requirements  1.3 Drawing equipment are used and maintained as per manufacturer‟s instructions  1.4 Drawing materials are used as per workplace procedures  1.5 Waste materials are disposed in accordance with workplace procedures and ***environmental legislations***  1.6 ***Personal Protective Equipment*** is used according to occupational safety and health regulations |

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| 2. Produce plain geometry drawings | 2.1 Different types of lines used in drawing and their meanings are identified according to standard drawing conventions  2.2 Different types of ***geometric forms*** are constructed according to standard drawing conventions  2.3 Different types of angles are constructed according to principles of trigonometry  2.4 Different types of angles are measured using appropriate measuring tools  2.5 Angles are bisected according to standard drawing conventions |
| 3. Produce solid geometry drawings | 3.1 Sketches and drawings of patterns are interpreted according to standard conventions  3.2 Patterns are developed in accordance with standard conventions |
| 4. Produce pictorial and orthographic drawings of components | 4.1 Different symbols and abbreviations  are identified and their meaning interpreted according to standard drawing conventions  4.2 Isometric sketches and drawings of components are interpreted and produced in accordance with the standard conventions of isometric drawings  4.3 First and third angle orthographic sketches and drawings of components are interpreted and produced in accordance with the standard conventions of orthographic drawings  4.4 Freehand sketching of different types of geometric forms, tools, equipment, diagrams and components is conducted |

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| 5. Produce assembly drawings | 5.1 Orthographic views are exploded according to standard conventions of orthographic drawings.  5.2 Pictorial views are exploded according to standard conventions of orthographic drawings.  5.3 Part lists are identified according to part to be produced  5.4 Sectional views are produced according to standard conventions of drawing.  5.5 Produced drawing is hatched according to standard conventions of drawings. |
| 6. Apply CAD packages in drawing | 6.1 CAD packages are selected according to task requirements  6.2 CAD packages are applied in production of engine parts, electrical and electronic circuits and vehicle body parts drawings |

**RANGE**

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| --- | --- |
| **Variable** | **Range** |
| 1. Drawing equipment may include but not limited to: | 1.1 Drawing boards  1.2 T-square  1.3 Set squares  1.4 Drawing set  1.5 Computers with CAD packages |
| 2. Drawing materials may include but not limited to: | 2.1 Drawing papers  2.2 Pencils  2.3 Erasers  2.4 Masking tapes  2.5 Paper clips |
| 3. Environmental legislations  may include but not limited to: | EMCA 1999 |
| 4. Personal Protective  Equipment may include but not limited to: | 4.1 Dust coats  4.2 Closed leather shoes  4.3 Goggles for CAD |
| 5. Geometric forms may include but not limited to: | 5.1 Circles  5.2 Triangles  5.3 Rectangles  5.4 Parallelogram  5.5 Polygons  5.6 Pyramids  5.7 Conic sections  5.8 Prisms  5.9 Loci |
| 6. Standard drawing conventions may include but not limited to: | 6.1 Anatomy of engineering drawing  (title block, coordinate grid system, revision block, notes  and legends)  6.2 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:  1.1 Applied and adhered to safety procedures  1.2 Cared and maintained drawing equipment  1.3 Interpreted circuit, assembly and lay out diagrams  1.4 Applied appropriate technical standards, used proper tools and equipment for a given task  1.5 Produced sketches and drawings  1.6 Applied CAD packages in production of drawings |
| 2. Resource Implications | Resources the same as that of workplace are advised to be applied.  2.1 Drawing room  2.2 Drawing equipment and materials  2.3 Computers  2.4 CAD packages |
| 3. Methods of  Assessment | Competency may be assessed through:  3.1 Practical tests  3.2 Observation |
| 4. Context of  Assessment | Competency may be assessed individually in the actual workplace or a simulated work place setting. |
| 5. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY ENGINEERING MATHEMATICS

**UNIT CODE: ENG/AUT/CC/2/6/A**

**UNIT DESCRIPTION:**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range.*** |
| 1. Apply Algebra | 1.1 Calculations involving Indices are performed as per the concept  1.2 Calculations involving Logarithms are performed as per the concept  1.3 Scientific calculator is used in solving mathematical problems in line with manufacturer‟s manual  1.4 Simultaneous equations are performed as per the rules  1.5 Quadratic equations are calculated as per the concept |

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| 2. Apply Trigonometry and hyperbolic  functions | 2.1 Calculations are performed using trigonometric rules  2.2 Calculations are performed using hyperbolic functions |
| 3. Apply complex numbers | 1.1 Complex numbers are represented using Argand diagrams  1.2 Operations involving complex numbers are performed  1.3 Calculations involving complex numbers are performed using De Moivre‟s theorem |
| 4. Apply Coordinate Geometry | 4.1 Polar equations are calculated using coordinate geometry  4.2 Graphs of given polar equations are drawn using the Cartesian plane  4.3 Normal and tangents are determined using coordinate geometry |
| 5. Carry out Binomial Expansion | 5.1 Roots of numbers are determined using binomial theorem  5.2 Errors of small changes are determined using binomial theorem |

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| 6. Apply Calculus | 6.1 Derivatives of functions are determined using Differentiation  6.2 Derivatives of hyperbolic functions are determined using Differentiation  6.3 Derivatives of inverse trigonometric functions are determined using Differentiation  6.4 Rate of change and small change are determined using Differentiation.  6.5 Calculation involving stationery points of functions of two variables are performed using differentiation.  6.6 Integrals of algebraic functions are determined using integration  6.7 Integrals of trigonometric functions are determined using integration  6.8 Integrals of logarithmic functions are determined using integration  6.9 Integrals of hyperbolic and inverse functions are determined using  integration |
| 7. Solve Ordinary differential equations | 7.1 First order and second order differential equations are solved using the method of undetermined coefficients  7.2 First order and second order differential equations are solved from given boundary conditions |

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| 8. Carry out Mensuration | 8.1 Perimeter and areas of figures are obtained  8.2 Volume and of Surface area of solids are obtained  8.3 Area of irregular figures are obtained  8.4 Areas and volumes are obtained using Pappus theorem |
| 9. Apply Power Series | 9.1 Power series are obtained using Taylor‟s Theorem  9.2 Power series are obtained using  McLaurin‟s „s theorem |
| 10. Apply Statistics | 10.1 Mean, median ,mode and Standard  deviation are obtained from given data  10.2 Calculations are performed based on Laws of probability  10.3Calculation involving probability distributions , mathematical expectation sampling distributions are performed  10.4 Sampling distribution methods are applied in data analysis  10.5 Calculations involving use of standard normal table, sampling distribution, T-distribution and estimation are done  10.6 Confidence intervals are determined |
| 11. Apply Numerical methods | 11.1 Roots of polynomials are obtained using iterative *numerical methods*  11.2 Interpolation and extrapolation are performed using numerical methods |
| 12. Apply Vector theory | 12.1 Vectors and scalar quantities are obtained in two and three dimensions  12.2 *Operations* on vectors are performed  12.3 Position of vectors is obtained  12.4 Resolution of vectors is done |
| 13. Apply Matrix | 13.1Determinant and inverse of 3x3 matrix are obtained  13.2Solutions of simultaneous equations are obtained  13.3Calculation 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.

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| **Variable** | **Range** |
| 1. Operations may include but not limited to: | 1.1. Addition  1.2. Subtraction |
| 2. Hyperbolic functions may include but not limited to: | 2.1. Sinh x  2.2. Cosh x  2.3. Cosec x  2.4. Coth x  2.5. Tanh x  2.6. Sech x |
| 3. Probability Distributions may include but not limited to: | 3.1. Binomial  3.2. Poisson  3.3. Normal |
| 4. Numerical Methods may include but not limited to: | 4.1. Newton Raphson  4.2. Gregory Newton |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skills:

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

**Required knowledge**

The individual needs to demonstrate knowledge of:

* 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.

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| --- | --- |
| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:  1.4 Applied Trigonometry and hyperbolic functions  1.5 Applied complex numbers  1.6 Applied Calculus  1.7 Solved Ordinary differential equations  1.8 Carried out mensuration  1.9 Applied Power Series  1.10 Applied Vector theory  1.11 Applied Matrix  1.12 Applied Numerical methods |
| 2. Resource Implications | The following resources should be  provided:  2.1 Access to relevant workplace or appropriately simulated environment where assessment can take place  2.2 Measuring equipment  2.3 Materials relevant to the proposed activity or tasks |
| 3. Methods of Assessment | Competency in this unit may be assessed through: 1.1 Direct Observation  1.2 Demonstration with Oral Questioning  1.3 Written tests |
| 4. Context of Assessment | Competency may be assessed individually in the actual workplace or through accredited institution |
| 5. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY MECHANICAL SCIENCE PRINCIPLES

**UNIT CODE: ENG/OS/ME/CC/3/06/A**

**UNIT DESCRIPTION**

This unit describes the competencies required by a technician in order to apply a wide range of Mechanical science principles in their work. It includes 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 | 1.1 Forces are defined and described  1.2 ***Forces theorems*** are described  1.3 Resultant of coplanar forces are determined. |
| 2. Demonstrate knowledge of moments | 2.1 Moments are defined  2.2 Moments are calculated  2.3 Principles of moments are described  2.4 Couples are identified and applied in engineering systems. |
| 3. Understand friction principles | 3.1 Laws of friction are identified  3.2 Limiting friction is calculated  3.3 Forces applied at an angle to a horizontal plane are calculated  3.4 Coefficient of friction is calculated   1. Advantages and disadvantages of friction are identified. |

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| 4. Understand motions in engineering | 4.1 Motion concepts are discussed  4.2 Laws of motion are identified  4.3 Motion calculations are performed  4.4 Displacement/time graphs are applied |
| 5. Describe work, energy and power | 5.1 Work is calculated  5.2 Energy is calculated  5.3 Power calculations are performed |
| 6. Perform machine  calculations | 6.1 ***Problems on simple machines*** are solved  6.2 Problems on levers are solved  6.3 Laws of machines are identified |
| 7. Demonstrate gas  principles | 7.1 Gas laws are identified  7.2 Gas laws are applied in solving engineering problems  7.3 Uses of gases in engineering systems are identified |
| 8. Apply heat knowledge | 8.1 Heat concepts are discussed  8.2 Working principle of heat is defined  8.3 Heat capacity is discussed  8.4 Heat problems are solved |
| 9. Apply density knowledge | 9.1 Density terminology are discussed  9.2 Density measurements are carried out  9.3 Density problems are solved |
| 10. Apply pressure principles | 10.1 Pressure concepts are discussed  10.2 Working principles of pressure is discussed  10.3 Pressure problems are solved  10.4 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.

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| --- | --- |
| **Variable** | **Range** |
| 1. Forces theorems may include but not limited to: | 1.1 Parallelogram  1.2 Triangle  1.3 Polygon |
| 2. Problems on simple machines may include but not limited to: | 2.1 Machine advantage  2.2 Velocity ratio  2.3 Efficiency |
| 3. Gas laws may include but not limited to: | 3.1 Boyles law  3.2 Charles law  3.3 Gas equation |
| 4. Density terminology may include but not limited to: | 4.1 Density  4.2 Relative density |
| 5. Pressure applications may include but not limited to: | 5.1 Vacuum pump  5.2 Hydraulic pump  5.3 Hydrometers |
| 6. Principles may include  but not limited to: | 6.1 Newton‟s laws of motion  6.2 Law of conservation of linear momentum  6.3 Law of conservation of energy  6.4 Archimedes‟ principle |
| 7. Mechanical calculations may include but not limited to: | 7.1 Mechanical advantage  7.2 Efficiency  7.3 Torque  7.4 Power/Energy  7.5 Work done |
| 8. Laws of fluids may include but not limited to: | 8.1 Pascal‟s principle  8.2 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:  1.1 Determined forces in a system  1.2 Demonstrated knowledge of moments  1.3 Understood friction principles  1.4 Understood motions in engineering  1.5 Described work, energy and power  1.6 Performed machine calculations  1.7 Demonstrated gas principles  1.8 Applied heat knowledge  1.9 Applied density knowledge  1.10 Applied pressure principles |
| 2. Resource Implications | The following resources should be provided:  2.1 Access to relevant workplace or appropriately simulated environment where assessment can take place  2.2 Measuring tools and equipment  2.3 Sample materials to be tested |
| 3. Methods of Assessment | Competency in this unit may be assessed through:  1.9 Direct Observation  1.10 Demonstration with Oral Questioning  1.11 Case studies  1.12 Written tests |
| 4. Context of  Assessment | Competency may be assessed individually in the actual workplace or through accredited institution |

## APPLY FLUID MECHANICS PRINCIPLES

**UNIT CODE: ENG/OS/ME/CC/4/06/A**

**UNIT DESCRIPTION**

This unit describes the competencies required by a 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**

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| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range.*** |
| 1. Understand flow of fluids | 1.1 Flow rate in pipes is measured  1.2 Losses in pipes are determined  1.3 ***Causes of losses*** in pipes are determined  1.4 Flow losses equations are applied in problem solving |
| 2. Demonstrate knowledge in viscous flow | 2.1 Viscous flow between parallel surfaces are explained  2.2 Viscous flow equations between parallel surfaces are derived and applied  2.3 Viscous flow equations in circular pipes are derived and applied in problem solving |
| 3. Perform dimensional analysis | 3.1 Dimensional analysis is explained  3.2 Principle of dimensional homogeneity is explained  3.3 Fundamental dimensions are stated  3.4 Dimensional units are defined  3.5 Physical quantities are identified  3.6 Dimensional analysis are applied in problem solving |
| 4. Operate fluid  pumps | 4.1 Principle of operation of pumps is described  4.2 Reciprocating pump equation is derived  4.3 Centrifugal pump equation is derived  4.4 Pump equations are applied in problem solving |

**RANGE**

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

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| --- | --- |
| **Variable** | **Range** |
| 1. Causes of losses may include but not limited to: | 1.1 Friction  1.2 Enlargement/reduction in crosssectional areas |
| 2. Physical quantities may include but not limited to: | 2.1 Mass  2.2 Force  2.3 Density  2.4 Velocity  2.5 Acceleration |
| 3. Applied may include but not limited to: | 3.1 Reynolds number  3.2 Mach number  3.3 Froude number |
| 4. Principle of operation may include but not limited to: | 4.1 Reciprocating  4.2 Centrifugal |
| 5. Reciprocating pump equation is derived may include but not limited to: | 5.1 Coefficient of discharge  5.2 Percentage slip  5.3 Work done  5.4 Acceleration head  5.5 Pressure head in the cylinder |
| 6. Centrifugal pump equation is derived may include but not limited to: | 6.1 Effective head  6.2 Monomeric head  6.3 Monomeric efficiency  6.4 Mechanical efficiency  6.5 Discharge  6.6 Torque  6.7 Work done unit weight  6.8 Specific speed |

**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:  1.1 Identified Principles of mechanical science  1.2 Performed mechanical calculations of a system  1.3 Identified types of forces on a system  1.4 Calculated resultant forces on plane framework  1.5 Identified application of forces on the production flow  1.6 Tested mechanical properties of a materials  1.7 Identified tools and equipment for measuring system parameters  1.8 Recorded and interpreted measured parameters.  1.9 Operated Power transmission systems |
|  |
| 1. Resource Implications | The following resources should be provided:  2.4 Access to relevant workplace or appropriately simulated environment where assessment can take place  2.5 Measuring tools and equipment  2.6 Sample materials to be tested |
| 2. Methods of Assessment | Competency in this unit may be assessed through:  2.1 Direct Observation  2.2 Demonstration with Oral Questioning  2.3 Case studies  2.4 Written tests |
| 4. Context of  Assessment | Competency may be assessed individually in the actual workplace or through accredited institution |
| 5. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY THERMODYNAMICS PRINCIPLES

**UNIT CODE: ENG/OS/ME/CC/5/06/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 | 1.1 Terms used in thermodynamics are described  1.2 Thermodynamics processes and cycles are described  1.3 First law of thermodynamics is applied |
| 2. Perform steady flow processes | 2.1 Steady flow energy equation is derived  2.2 Steady flow energy equation is applied in problem solving  2.3 Steady flow energy equation is applied in ***utilities*** |
| 3. Perform non steady flow processes | 3.1 Non-flow energy equation is derived  3.2 Non-flow energy equation is applied in problem solving |

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| 4. Understand perfect gases | 4.1 ***Perfect gas laws*** are stated  4.2 Gas laws experiment are carried out  4.3 Gas laws are applied |
| 5. Generate steam | 5.1 Dryness fraction is determined  5.2 Relationship between pressure and boiling point is determined  5.3 Energy balance is carried out  5.4 Relationship between temperature and pressure is determined. |
| 6. Perform thermodynamics reversibility and entropy | 6.1 Thermodynamics reversibility is explained  6.2 Principles of heat engine are explained  6.3 Second law of thermodynamics is applied  6.4 Entropy is explained in thermodynamics cycle |
| 7. Understand idea gas cycle | 7.1 Ideal gas cycle processes are explained  7.2 Air standard efficiency and actual efficiency are differentiated  7.3 Problems are solved in ideal gas cycle |
| 8. Demonstrate fuel and combustion | 8.1 Fuels are classified  8.2 Properties of fuels are described  8.3 Combustion equation are derived  8.4 Combustion equation is applied to combustion and exhaust gas problems |

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| 9. Perform heat transfer | 9.1 Conduction equation is derived and applied from Fourier‟s law  9.2 Heat transfer equation is derived and applied from Newton‟s law of cooling and Fourier‟s law |
| 10. Understand heat exchangers | 10.1 Heat exchangers are classified 10.2 Recuperative heat exchangers are described  10.3 Heat equations are applied to solve heat exchanger problems |
| 11. Understand air compressors | 11.1 Air compressors are classified 11.2 Types of air compressors are described  11.3 Equations of reciprocating compressors are derived and applied |
| 12. Understand gas turbines | 12.1 Theoretical cycle for gas turbines is explained  12.2 Open cycle gas turbine is described  12.3 Closed cycle gas turbine is described  12.4 Gas turbine equations are derived and applied |
| 13. Understand impulse steam turbines | 13.1 ***Principles of operations*** of the impulse steamturbines is described  13.2 Impulse steam turbine equation is derived and applied |

**RANGE**

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

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| --- | --- |
| **Variable** | **Range** |
| 1. Utilities may include but not limited to: | 1.1 Boilers  1.2 Condensers  1.3 Compressors  1.4 Nozzles  1.5 Throttling processes |
| 2. Perfect gas laws may include but not limited to: | 2.1 Boyle‟s law  2.2 Charles‟s law  2.3 Joule‟s law |
| 3. Principles may include but not limited to: | 3.1 Newton‟s laws of motion  3.2 Law of conservation of linear momentum  3.3 Law of conservation of energy  3.4 Archimedes‟ principle |
| 4. Types of air compressors may include but not limited to: | 4.1 Reciprocating  4.2 Blowers  4.3 Sliding valves |
| 5. Types of air compressors may include but not limited to: | 5.1 Compounding  5.2 Multistage impulse turbine |

**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:  1.1 Identified Principles of mechanical science  1.2 Performed mechanical calculations of a system  1.3 Identified types of forces on a system  1.4 Calculated resultant forces on plane framework  1.5 Identified application of forces on the production flow  1.6 Tested mechanical properties of a materials  1.7 Identified tools and equipment for measuring system parameters  1.8 Recorded and interpreted measured parameters.  1.9 Operated Power transmission systems |
| 2. Resource Implications | The following resources should be provided:  2.7 Access to relevant workplace or appropriately simulated environment where assessment can take place  2.8 Measuring tools and equipment  2.9 Sample materials to be tested |
| 3. Methods of Assessment | Competency in this unit may be assessed through:  2.5 Direct Observation  2.6 Demonstration with Oral Questioning 2.7 Case studies |
|  | 2.8 Written tests |
| 4. Context of assessment | Competency may be assessed individually in the actual workplace or through accredited institution |
| 5. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY MATERIAL SCIENCE AND PERFORM METALLURGICAL PROCESSES

**UNIT CODE: ENG/OS/ME/CC/6/06/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 keyoutcomes which make upworkplace function | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements  ***(Bold and italicized terms are elaborated in the Range)*** |
| 1. Analyze properties of engineering materials | 1.1 Type of engineering materials is identified as per the procedures  1.2 ***Physical properties*** of engineering material are determined  1.3 ***Mechanical properties*** of engineering materials are tested  1.4 Crystal structure of materials are analyzed |
| 2. Perform ore extraction processes | 2.1 Safety procedures are observed according OSHA  2.2 Method of extraction is determined as per material properties and its composition  2.3 Procedure in extraction process is determined as per extraction method  2.4 Extraction by- products are stored as per SOPs  2.5 Extraction by- products are disposed as per SOPs |

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| 3. Produce iron materials | 3.1 Perform ore smelting according to standard operating procedures.  3.2 ***Composition of iron*** is determined  3.3 Method of producing ***iron material*** is established  3.4 Refinement processes are identified based on iron material required |
| 4. Produce alloy materials | 4.1 Materials in alloy formation are identified  4.2 Alloy formation process is identified based on alloy to be produced  4.3 Alloy tested based on alloy production requirement |
| 5. Produce non-ferrous materials | 5.1 **Non-ferrous materials** are extracted according to SOP  5.2 Extracted non-ferrous material is smelted and purified as per the SOP  5.3 Non-ferrous material is tested according to SOP  5.4 Alloying elements for nonferrous materials are identified  5.5 Alloy formation process is identified based on alloy to be produced  5.6 Alloys for non-ferrous material are tested based on production requirement |

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| 6. Produce ceramics materials | 6.1 Composition of **ceramic materials** is identified  6.2 Manufacturing process is identified  6.3 Ceramic materials are produced according to manufacturing processes  6.4 ***Finishing processes*** are identified |
| 7. Produce composite materials | 7.1 Type of composite to be produced is identified  7.2 Elements involve in composite formation are identified  7.3 Formation process of composite to be produced is identified  7.4 Composite is tested as per composite production requirement |

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| 8. Utilise ***other engineering materials*** | 8.1 Identify and select engineering material according to production requirements.  8.2 Operation plan is developed according to engineering drawing.  8.3 Appropriate machine is set up according to manufacturer‟s manual  8.4 Production parameters are set according to production requirement  8.5 Production is performed |
| 9. Perform heat treatment | 9.1 Safety practices are observed according to OSHA 2007  9.2 **Heat treatment processes** are identified  9.3 Procedure in heat treatment processes  9.4 Heat treatment of metals are performed |
| 10. Perform material testing | 10.1 Safety is observed in material testing procedures  10.2 **Material testing methods** are identified depending on material  to be tested  10.3 Procedure of material testing is followed as per material testing method  10.4 Material testing results are tabulated, calculated and interpreted  10.5 Material testing equipment are taken care of and maintained. |
| 11. Prevent material corrosion | 11.1 Safety is observed during corrosion  11.2 Prevention  11.3 Corrosion type is identified  11.4 Corrosive atmosphere is identified  11.5 Methods of corrosion prevention are identified  11.6 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** |
| 1. Physical properties may include but not limited to: | 1.1 Density  1.2 Color  1.3 Texture  1.4 Melting point  1.5 Thermo conductivity  1.6 Electrical resistivity |
| 2. Mechanical properties may include but not limited to: | 2.1 Ductility  2.2 Malleability  2.3 Elasticity  2.4 Toughness  2.5 Hardness  2.6 Brittleness  2.7 Plasticity  2.8 Strength |
| 3. Composition of iron may include but not limited to: | 3.1 Iron (II) oxide  3.2 Iron (III) oxide |
| 4. Iron materials may include but not limited to: | 4.1 Cast iron  4.2 Steel |
| 5. Non-ferrous materials may include but not limited to: | 5.1 Aluminium  5.2 Copper |
| 6. ceramic materials may include but not limited to: | 6.1 oxides  6.2 nitrides  6.3 carbides  6.4 silica |
| 7. Finishing processes may include but not limited to: | 7.1 Lapping  7.2 Fine grinding  7.3 Polishing |
| 8. Other engineering materials may include but not limited to: | 8.1 Rubber  8.2 Plastics  8.3 Wood  8.4 Glass |
| 9. Corrosion type may include but not limited to: | 9.1 Galvanic  9.2 Stress corrosion cracking |
| 10. Methods of corrosion prevention may include but not limited to: | 10.1 Painting  10.2 Electroplating  10.3 Galvinizing  10.4 Cathodic  10.5 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  1.1 Observed safety as per work place procedures  1.2 Demonstrated understanding of physical, chemical and mechanical properties of engineering materials  1.3 Performed extraction processes  1.4 Produced iron materials  1.5 Produced ceramics  1.6 Produced composites  1.7 Produced alloys  1.8 Performed heat treatment  1.9 Performed material testing  1.10 Demonstrated understanding of corrosion types and its prevention |
| 2. Resource Implications | 2.1 Testing materials  2.2 Extraction materials  2.3 Measuring instruments  2.4 Inspection tools |
| 3. Methods of  Assessment | Competency may be accessed through:  3.1 The behaviour of the learner in the working environment  3.2 Inpection of finished product  3.3 Process analysis |
| 4. Context of  Assessment | Competency may be assessed individually in the actual workplace or through accredited institution |
| 5. Guidance information for assessment | Holistic assessment of other units relevant to the industry sector, workplace and job role is recommended. |

# 

# CORE UNITS OF COMPETENCY

## PRODUCE PARTS BY BENCH WORK

**UNIT CODE: ENG/OS/ME/CR/1/06/A**

**UNIT DESCRIPTION**

The learner will be able to use different methods to produce workpieces using basic hand tools while observing occupational safety and health legislations, regulations and safe working practices. In the context of the standards, the learner is to interpret and work within given specifications, select techniques and make variations to achieve specified results as well as perform housekeeping.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range*** |
| 1. Use personal protective equipment | 1.1 Prescribed personal safety gear is worn as per work place procedure.  1.2 Prescribed safety measures for the operation of hand tools and drilling machines adhered to as per rules and regulations  1.3 Prescribed safe work environment is observed as per rules and regulations  1.4 Prescribed workplace procedures are adhered to. |
| 2. Organize work area | 2.1 Working tools, measuring tools, equipment‟s and materials are organized and stored as per organization policy.  2.2 Housekeeping is carried out as per work place requirement.  2.3 Waste is segregated and disposed as per disposal guidelines. |

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| 3. Use a technical drawing to plan work operations | 3.1 Technical drawing sand geometric symbols are read and interpreted as per ***drawing standards.***  3.2 ***Operation Plan*** is produced as per the technical drawings.  3.3 Technical drawings are produced ***as*** per drawing Standards. |
| 4. Measure and mark out dimensions on work pieces | 4.1 Measuring tools suitable for the work are selected  4.2 Measuring tools are inspected and calibrated if required  4.3 Dimensions are marked on the work piece as per technical drawing standards |
| 5. Set up work pieces on holding devices | 5.1 Work piece is mounted on ***workholding devices***  5.2 Work piece is clamped securely on work holding devices. |
| 6. Use hand tools to cut and  file parts | 6.1 ***Hand tools*** are selected based on operation plan  6.2 Work piece is cut to specification  6.3 Work piece is filed to specification  6.4 Part are produced to ***specifications*** |

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| 7. Use a hand drill to drill holes | 7.1 Hole centers are marked and centerpunched as per operation plan.  7.2 Drill bits are selected and mounted  7.3 Work piece is mounted and clamped  7.4 ***Hole is drilled*** to specification  7.5 Holes inspected to ***specification*** |
| 8. Threading using taps and dies | 8.1 Taps and dies selected based on operation plan.  8.2 Taps and dies are set up on the work piece  8.3 ***Threads are*** cut to specification |
| 9. Assemble metal parts and sub-assemblies | 9.1 Parts ***joined***, fitted and assembled  9.2 Final assembly inspected as per specification |
| 10. Polish finished work | 10.1 ***Polishing*** material are selected  10.2 Finished work is cleaned  10.3 Finished work is polished to specification |
| 11. Inspect finished work for accuracy and quality | 11.1 Inspection tools and methods selected as per operation plan  11.2 Finished work is inspected as per specification  11.3 Adjustments are made based on inspections results |
| 12. Maintenance of tools and equipment | 12.1 Machines and tools are inspected  12.2 Machines and tools are lubricated  12.3 Faults on machines and tools are identified and reported  12.4 Stow tools and equipment |
|  |  |

**RANGE**

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

|  |  |
| --- | --- |
| **VARIABLE** | **RANGE** |
| 1. Measuring tools may include but not limited to: | 1.1 Steel rule  1.2 Vernier caliper  1.3 Micrometer screw gauge  1.4 Vernier height gauge |
| 2. Drawing Standards may include but not limited to: | 2.1 ISO  2.2 BS  2.3 ANSI |
| 3. Operation Plan may include but not limited to: | 3.1 Sequence of operations  3.2 Measuring tools  3.3 Hand tools  3.4 Cutting tools  3.5 Inspection tools |
| 4. Marking out tools may include but not limited to: | 4.1 Scribers  4.2 Dividers  4.3 Dot punch  4.4 Centre punch  4.5 Engineers square  4.6 Straight edge  4.7 Surface plate |

|  |  |
| --- | --- |
| 5. Work holding devices may include but not limited to: | 5.1 Bench vice  5.2 V-Block  5.3 Angle plate  5.4 G-clamp  5.5 Jigs and fixtures  5.6 Hand vice |
| 6. Hand tools may include but not limited to: | 6.1 Files  6.2 Saws  6.3 Hammers  6.4 Chisels  6.5 Taps and dies |
| 7. Threads may include but not limited to: | 7.1 Internal and external threads  7.2 V-profile threads |
| 8. Polishing may include but not limited to: | 8.1 Emery cloth  8.2 Polishing and burnishing machine 8.3 Filing |
| 9. Hole drilled may include but not limited to: | 9.1 Location  9.2 Counter sinking  9.3 Counter boring  9.4 Reaming  9.5 Boring |
| 10. Joining may include but not limited to: | 10.1 Riveting  10.2 Fastening  10.3 Soldering  10.4 Brazing  10.5Welding |
| 11. Specifications may include but not limited to: | 11.1 Dimensions  11.2 Tolerances |
|  | 11.3 Geometry  11.4 Surface finish  11.5 Functionality |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skills:

* Technical drawing
* Using measuring and inspection tools
* Using hand tools
* Using portable and bench drilling machines
* Soldering and brazing
* Riveting and fastening

**Required Knowledge**

The individual needs to demonstrate knowledge and understanding of:

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

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of  Competency | Assessment requires evidence that the learner:  1.1 Observed rules and procedures in bench work  1.2 Interpreted technical drawing  1.3 Produced operation plan  1.4 Produced holes on a work piece  1.5 Threaded using taps and dies  1.6 Assembled metal parts  1.7 Polished finished work  1.8 Maintained tools and equipment  1.9 Did housekeeping before, during and after operations |
| 2. Resource Implications | 1.1 Hand measuring tools  1.2 Hand marking tools  1.3 Hand tools  1.4 Inspection tools and equipment  1.5 Hand drilling machine  1.6 Bench Drilling machine  1.7 Work benches  1.8 Bench vices  1.9 ISO, BS and ANSI standards  1.10 Rules and procedures  1.11 Resource materials, manuals for bench, tools and equipment  1.12 Materials |
|  | 1.13 Cutting tools |
| 3. Methods of  Assessment | Competency may be assessed through:  1.1 Observing the behaviour of the learner  1.2 Oral presentations  1.3 Inspection of written operation procedures  1.4 Inspection of finished product  1.5 Observing housekeeping of the work area and/or machine tool |
| 4. Context of  Assessment | Competency may be assessed individually in the actual workplace or through accredited institution |
| 5. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## FABRICATE SHEET METAL PARTS

**UNIT CODE: ENG/OS/ME/CR/2/06/A**

**UNIT DESCRIPTION**

This unit describes occupational standards for sheet metal work. The technician will be able to use different techniquesfor fabricating parts using sheet metal while observing rules and procedures. In the context of the standards, the technician is to interpret and work within given specifications, select techniques and make variations to achieve specified results as well as perform housekeeping.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 1. Observe safety and regulations | 1.1 Prescribed personal safety gear is worn as per work place procedure.  1.2 Prescribed safe work environment is observed as per rules and regulations/  1.3 Prescribed workplace procedures are adhered to. |
| 2. Identify parts of sheet metal machine tool | 2.1 Identification of Types of sheet metal machine tools  2.2 Parts of sheet metal machine  2.1 Functions of the parts of a sheet metal machine |
| Use sheet metal tools | 2.2 Sheet metal tools selected |

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 1. Observe safety and regulations | 1.1 Prescribed personal safety gear is worn as per work place procedure.  1.2 Prescribed safe work environment is observed as per rules and regulations/  1.3 Prescribed workplace procedures are adhered to. |
|  | 2.1 Sheet metal tools used |
| 3. Read and interpret working drawing | 3.1 Technical drawings and geometric symbols are read and interpreted as per drawing standards.  3.2 Operation Plan is produced as per the technical drawings.  3.3 Technical drawings are produced as per drawing Standards |
| 4. Mark out of work pieces | 4.1 Work piece dimensions are measured as per operation plan  4.2 Dimensions are marked on work piece as per operational plan |
| 5. Set- up sheet metal machine | 5.1 Machine tools selected as per operation plan 5.2 Marking and measuring tools selected as per specifications  5.3Attachmentmountained as per machine manual  6.1 Accessories mounted as per machine manual |
| 1. Observe safety and regulations | 1.1 Prescribed personal safety gear is worn as per work place procedure.  1.2 Prescribed safe work environment is observed as per rules and regulations/  1.3 Prescribed workplace procedures are adhered to. |
| 6. Produce fabricated component (s) according to specifications | 6.1 Sheet metal work pieces are produced as per operation plan  6.2 Forming processes are produced as per operational plan surfaces are joined as per operation plan |
| 7. Assess functionality of fabricated component(s) | 7.1 Finished work is cleaned  7.2 Finished work is measured and inspected to specification  7.3 Finished work is tested for function ability |
| 8. Maintain sheet metal machines | 8.1 Machines and tools are inspected  8.2 Machines and tools are lubricated  8.3 Faults on machines and tools are identified and reported  Stow tools and equipment |
| 9. Perform housekeeping | 9.1 Work environment cleaned  9.2 Tools and equipment cleaned and stored |

**RANGE**

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

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Drawing Standards includes but not limited to | 1.1 ISO  1.2 BS  1.3 ANSI |
| 2. Operation Plan includes but not limited to | 2.1 Sequence of operations  2.2 Measuring tools  2.3 Hand tools  2.4 Cutting tools  2.5 Inspection tools |
| 1. Specifications includes but not limited to | 3.1 Dimensions  3.2 Tolerances  3.3 Geometry  3.4 Surface finishing  3.5 Functionality  3.6 Visual inspection |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skills:

* Technical drawing
* Sheet metal development
* Soldering
* Welding
* Seaming
* Riveting
* Bolting
* brazing
* Use of the Guillotine, bending and rolling machines
* Use of hand tools to cut, fold and form sheet metal
* Production of holes in sheet metal
* Measuring and marking

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Occupational Health and Safety Act of Kenya laws 2007 with focus on personal safety, machine safety and workplace
* National Environment Management Authority Act, Kenya 2004
* OSH act
* Equipment manuals
* Technical drawing complyingto ISO, ANSI & BS standards
* ISO 1101 Geometrical tolerance and where to use the norm
* Measuring tools
* Hand tools
* Sheet metal development
* Joining methods (bolts, screws, rivets, seams, soldering, brazing and welding)
* Cutting, bending, and rolling machines
* Drilling,and punching machines,drills and punches
* WIBA act (2007)
* Report writing

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the learner:  1.1 Observed rules and procedures in bench work  1.2 Interpreted technical drawing  1.3 Produced operation plan  1.4 Laid out dimensions on work piece  1.5 Fabricated sheet metal work piece  1.6 Inspected finished work piece to specification  1.7 Maintained tools and equipment‟s  1.8 Did housekeeping before, during and after operations |
| 2. Resource Implications | 2.1 Cutting Machine  2.2 Rolling Machine  2.3 Bending machine  2.4 Punching machine  2.5 Drilling machine  2.6 Hand shearing machine  2.7 Hand tool and measuring instruments  2.8 Inspection tools  2.9 Gas welding set  2.10 Sheet metal materials  2.11 Resource materials, manuals for cutting tools and machine tools  2.12 Material safety data sheets  2.13 Occupational and safety act Kenya 2007 |
| 3. Methods of | Competency may be assessed through: |
| Assessment | 3.1. Observing the behaviour of the learner  3.2. Inspecting of the written operation procedures  3.3. Inspecting the quality of the finished product with regards to drawing specification and tolerances.  3.4. Observing housekeeping by the learner  3.5. Observed the maintenance of tools and equipment |
| 4. Context of  Assessment | Competency may be assessed individually in the actual workplace or through accredited institutions |
| 5. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## JOIN PARTS BY MANUAL METAL ARC WELDING (MMAW)

**UNIT CODE: ENG/OS/ME/CR/3/06/A**

**UNIT DESCRIPTION**

This unit describes occupational standards for manual metal Arc welding. The technician will be able to use different techniques in arc welding while observing rules and procedures. In the context of the standards, the technician is to interpret and work within given specifications, select techniques and make variations to achieve specified results as well as perform housekeeping.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 1. Observe safety and regulations | 1.1 Prescribed personal safety gear is worn as per work place procedure.  1.2 Prescribed safety measures for the operation of welding machines adhered to as per rules and regulations  1.3 Prescribed safe work environment is observed as per rules and regulations  1.4 Prescribed workplace procedures are adhered to |
| 2. Identify parts of arc welding machine | 2.1 Manual arc welding defined  2.2 Manual arc welding machines identified  2.3 Parts and functions of manual arc welding machines defined |

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| --- | --- |
| 3. Identify weld joints and welding positions | 2.4 Welding joints defined***.***  2.5 ***Welding symbols defined***  3.1 Weld profiles identified  3.2 Welding positions defined  3.3 Welding defects explained |
| 4. Use electrodes | 4.1 Types of electrodes identified  4.2 Electrodes classified  4.3 ***Electrodes*** are stored in dry environment  4.4 Moist electrodes preheated until dry  4.5 Electrodes stored in airtight containers |
| 5 Read and  interpret working drawing | 5.1 Technical drawings and geometric symbols are read and interpreted as per ***drawing standards.***  5.2 ***Operation Plan*** is produced as per the technical drawings.  5.0 Technical drawings are produced ***as*** per drawing Standards. Parts aligned and weldgap provided for. |
| 6 Prepare work piece | 6.1 Joint area cleaned and dried  6.2 ***Measuring***, ***marking*** and ***hand*** tools selected  6.3 Joint position measured and marked  6.4 Joint profile prepared based on joint type  6.5 Parts aligned and weldgap provided for |
| 7 Setup the Arc welding parameters | 1. Electrode selected based on operation plan 2. AC/DC set according to the specification of the drawing, material and type of weld 3. Current set according to specifications of the drawing, material and type of weld 4. ***Polarity*** chosen based on specification of the drawing, material and type of weld |

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| --- | --- |
| 8 Produce arc welded component(s) | 8.1 Workpieces are aligned and clamped  8.2 Parts are joined as per specified ***joint symbol*** and ***weldposition***  8.3 Root run and other weld layers welded until  joint fills  8.4 Weld shaped according to specifications |
| 9 Assess weld  quality | 9.1 Visual inspection carried out  9.2 ***Destructive testing***and inspection carried out  9.3 ***Non-destructive testing*** and inspection carried out |
| 10. Caring and maintenance of welding machine | 10.1 Machines and tools are inspected  10.2 Machines and tools are lubricated  10.3 Faults on machines and tools are identified and reported  10.4 Stow tools and equipment |
| 11. Perform housekeeping | 11.1 Working tools, measuring tools, equipment‟s and materials are organized and stored as per organization policy.  11.2 Housekeeping is carried out as per work place requirement.  11.3 Waste is segregated and disposed as per disposal 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** |
| 1. Technical drawing Standards include but is not limited to: | 1.1 ISO  1.2 BS  1.3 ANSI |
| 2. Geometry include but is not limited to: | 2.1 Form  2.2 Orientation  2.3 Location |
| 3. Operation Plan include but is not limited to: | 3.1 Sequence of operations  3.2 Measuring tools  3.3 Hand tools |
| 4. Marking out tools include but is not limited to: | 4.1 Scribers  4.2 Dividers  4.3 Engineers square  4.4 Straight edge |

|  |  |
| --- | --- |
| 5. Measuring tools include but is not limited to: | 5.1. Steel rule  5.2. Vernier caliper |
| 6. Hand tools include but is not limited to: | 6.1 Files  6.2 Saws  6.3 Hammers  6.4 Hand grinder  6.5 Wire brush  6.6 Clamps  6.7 Welding jigs and fixtures |
| 7. Electrodes include but is not limited to: | 7.1 Coated Mild Steel electrodes  7.2 Coated Low-Alloy Steel electrodes  7.3 Special metals electrodes |
| 8. Polarity include but is not limited to: | 8.1 Electrode-positive (reversed)  8.2 Electrode-negative (straight) |
| 9. Weld positions include but is not limited to: | 9.1 Welding performed on flat surface leftright or right-left  9.2 Welding performed in the horizontal position  9.3 Welding performed on vertical surface up and down and  down-up  9.4 Welding performed on overhead position |
| 10. Non-destructive testing include but is not limited to: | 10.1 Visual inspection  10.2 Radiographic   1. 3.Infrared Thermography    1. Ultrasonic    2. Magnetic particle    3. Dye penetrant |
| 11. Destructive testing include but is not limited to: | 11.1 Bend test  11.2 Tensile test |

**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:

* Welding
* Measuring
* Technical drawing
* Material testing  Weld inspection
* Weld positions
* Non-destructive testing (NDT)
* Destructive testing (DT)

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Occupational Health and Safety Act of Kenya laws 2007 with focus on personal safety, machine safety and workplace
* National Environment Management Authority Act, Kenya 2004
* OSH act
* Equipment manuals
* Technical drawing complyingto ISO, ANSI & BS standards
* Geometrical tolerance
* Work planning and documentation
* Measuring tools
* Hand tools
* Arc welding tools
* Weld defects and prevention measures
* Angle grander
* Inspection and quality control
* Materials and metallurgy
* WIBA act (2007)
* Report writing

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of  Competency | Assessment requires evidence that the learner:  1.1 Observed rules and procedures in manual arc welding  1.2 Produced work to specified dimensional tolerances, geometry and surface finish  1.3 Used technical information and recommendations in planning and tasks execution  1.4 Took care of electrodes  1.5 Set up the arc welding parameters  1.6 Welded and inspected parts  1.7 Maintained housekeeping procedures |
| 2. Resource Implications | 2.1 Arc welding machine  2.2 Electrodes  2.3 Measuring tools  2.4 Marking tools  2.5 Hand tools  2.6 Inspection tools and equipment  2.7 Angle grinder  2.8 Work benches  2.9 Bench vices  2.10 Rules and procedures |
| 3. Methods of Assessment | Competency may be assessed through:  3.1 Observing the learner perform manual arc welding  3.2 Inspection of written operation procedures  3.3 Inspection of finished product with regard to quality specifications  3.4 Observing housekeeping of the work area  3.5 Observing housekeeping of the welding machine |
| 4. Context of Assessment | Competency may be assessed individually in the actual workplace or through accredited institution |
| 5. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## PERFORM LATHE WORK

**UNITCODE: ENG/OS/ME/CR/4/06/A**

**UNIT DESCRIPTION:**

The learner will be able to prepare a machine tool and do machining to achieve material removal whilst adhere to rules and procedures. In the context of this standard, the learner is to interpret and work within given specifications, selecting techniques and making variations to achieve specified results well as perform housekeeping.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 1. Use personal protective equipment | 1.1 Prescribed personal safety gear is worn as per work place procedure.  1.2 Prescribed safety measures for the operation of hand tools and drilling machines adhered to as per rules and regulations  1.3 Prescribed safe work environment is observed as per rules and regulations  1.4 Prescribed workplace procedures are adhered to |
| 2. Identify machine parts and their functions | 2.1 A lathe is defined  2.2 Types of lathe are identified  2.3 Parts of a lathe are identified  2.4 Functions of the parts of a lathe are defined |
| 3. Use a technical drawings to plan work operations | 3.1 Technical drawings and geometric symbols are read and interpreted as per ***drawing standards.***  3.2 ***Operation Plan*** is produced as per the technical drawings.  3.3 Technical drawings are produced ***as*** per drawing Standards. |

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| 4. Calculate speed and feed rate | 4.1 Speed to be used is calculated the as per the operation plan  4.2 Feed rate is calculated as per operational plan |
| 5. Setup machine tools | 5.1 Machine tools are selected  5.2 Marking and measuring tools are selected  5.3 Work piece marked as pper operation plan  5.4 Speed and feed selected as per the machine manual  5.5 ***Cutting tools*** positioned  5.6 Chuck is mounted as per the machine manual |
| 6. Mount work piece | 1. Work piece is mounted on the chuck 2. Work piece supported by tailstock and collets 3. True running of the work piece is observed |
| 7. Perform machining | 7.2 Work piece machined to specified dimensions  7.2 Work piece machined to specified surface finish  7.3 Dimensions of finished workpiece checked as per specification. |

|  |  |
| --- | --- |
| 8. Maintain of tools and equipment | 8.1 Machines are inspected  8.2 Machines and tools are lubricated  8.3 Faults on machines and tools identified and reported  8.4 Stow tools and equipment  8.5 Machine guard inspected as per machine manual |
| 9. Set up machine tool for specific job | 9.1 Machine tools selected as per operation plan  9.2 Marking and measuring tools selected as per specifications  9.3 Speed and feed rate selected as per machine manual  9.4 ***Attachment is*** mountained as per machine manual  9.5 Cutting tools mounted as per machine manual |
| 10. Assess quality of  Machined parts | 10.1 Inspection tools and methods selected as per operation plan  10.2.Finished work is inspected as per specification  10.3.Adjustments are made based on inspections results |
| 11.Maintain of machine tool | 11.1 Machines are inspected  11.2 Machines and tools are lubricated  11.3 Faults on machines and tools identified  and reported  11.4 Stow tools and equipment  11.5 Machine guard inspected as per machine  manual |
| 12. Perform housekeeping | 12.1 Working tools, measuring tools, equipment‟s and materials are organized and stored as per organization policy.  12.2 Housekeeping is carried out as per work place requirement.  12.3 Waste is segregated and disposed as per disposal 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** |
| 1. Technical drawing Standards includes but not limited to; | 1.1 ISO  1.2 BS  1.3 ANSI |
| 2. Cutting tools includes but not limited to; | 3.1 Knurling tools  3.2 Threading  3.3 Turning  3.4 Boring  3.5 Parting  3.6 Drilling bits |
| 3. Specifications includes but not limited to; | 3.1 Dimensions  3.2 Geometry  3.3 Surface finishing  5.4 Functionality |
| 4. Operation plan includes but not limited to; | 4.1 Sequence of operations  4.2 Measuring tool  4.3 Cutting tool including cutting data  4.4 Production time  4.5 Speed and feeed rate  4.6 Cutting angles |

**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:

* Welding
* Measuring and marking
* Technical drawing
* Material testing  Weld inspection
* Weld positions
* Non-destructive testing (NDT)
* Destructive testing (DT)

**Required knowledge**

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

* Occupational Health and Safety Act of Kenya laws 2007 with focus on personal safety, machine safety and workplace
* National Environment Management Authority Act, Kenya 2004
* OSH act
* Equipment manuals
* Technical drawing complyingto ISO, ANSI & BS standards
* Geometrical tolerance
* Metal cutting processes using HM & HSS cutting tools
* Measuring tools
* Preventive maintanance
* Inspection and quality control
* Lathe operations
* CNC
* CAD
* Taper turning
* 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:  1.1 observed safety as per work place procedures  1.2 Developed operation plan  1.3 Calculated speed and feed rate  1.4 Selected cutting tools, speed & feed rates  1.5 Inspected the product and specified tolerances and checked finish  1.6 Set up machine tools  1.7 Mounted work piece  1.8 Observed housekeeping before, during and after operations |
| 2. Resource Implications | 2.1 Lathe  2.2 Cutting tools  2.3 Measuring tools  2.4 Material  2.5 Resource materials, manuals for cutting tools & lathe  2.6 Work place procedures |
| 3. Methods of  Assessment | Competency may be assessed through:  3.1 Observing the behaviour of the learner  3.2 Inspection of produced operation procedures  3.3 The quality controlof the finished product with regards to drawing specification and tolerances.  3.4 Observing housekeeping rules and regulation  3.5 Observing maintenance of the lathe |
| 4. Context of  Assessment | Competency may be assessed individually in the actual workplace or through accredited institution |
| 5. Guidance information for assessment | Holistic assessment of other units relevant to the industry sector, workplace and job role is recommended. |

## PRODUCE PARTS BY MILLING

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

**UNIT DESCRIPTION:**

The learner will be introduced to machining and cut technology and achieve material removal as per the specifications, whilst adhere to safety and health regulations. In the context of this standard, the learner is to interpret and work within given specifications, selecting techniques and making variations to achieve specified results as well as perform housekeeping.

**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 italised terms are elaborated in the Range*** |
| 1. Observing safety and regulations | 1.1 General safety  1.2 Use of PPE‟s (Overall, eye shield, safety shoes)  1.3 Machine safety  1.4 Occupational safety and health act, 2007  1.5 OSH Act 2007  1.6 WIBA Act 2007 |
| 2. Identify machine parts and their functions | 2.3 Milling machine tool  2.4 Types of milling machine  2.5 Parts of a milling machine  2.6 Functions of the parts of a milling machine |
| 3. Using milling cutters | 2.1 Milling cutter materials  2.2 Geometry of milling cutters  2.3 Selection of milling cutters  2.4 Mounting of milling cutters  2.5 Sharpening of milling cutters |

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| 4. Using cutting fluids | 4.1 Types of cutting fluids  4.2 Composition of cutting fluids  4.3 Selection of cutting fluids  4.4 Uses of cutting fluids  4.5 Advantages/disadvantages of cutting fluids  4.6 Handling of cutting fluids |
| 5. Identify milling operations | 5.1 Milling operations are identified  5.2 Speed and feed rate selected based on operation plan |
| 6. Read and interpret working drawing | 6.1 Reading and extraction of information  (dimensions, tolerances, BS/ANSI Drawing standards, geometric ISO symbols & abbreviations) 6.2 Development of operational plan |
| 7. Mark out of work piece | 7.1 Laying out work piece(s)  7.2 Marking out dimensions in work piece |
| 8. Set up milling machine tool for a  specific operation | 8.1 Identifying milling operation  8.2 Selecting and mounting milling cutters  8.3 Securing work piece  8.4 Calculating speed and feed rate  8.5 Selecting milling speed and feed rate |
| 9. Produce milled parts according to specifications | 9.1 Work piece set for the slot milling  9.2 Work piece and cutter aligned as operation plan  9.3 Correct depth of cut set as per operation plan  9.4 Work piece milled as per **specifications** |
| 10. Assessing quality of machined parts | 10.1 Surface finish  10.2 Functionality  10.3 Dimension and tolerance to specification |
| 11. Maintenance of milling machine tool | 11.1 milling machine tool cleaned after operations  11.2 milling machine Serviced and maintained (lubrication, inspection, alignment and adjustment) |
| 12. Perform housekeeping | 12.1 work environment cleaned (waste sorting and disposal)  12.2 tools and equipment cleaned and stored |

**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. Technical drawing Standards includes but not limited to; | 1.1 ISO  1.2 BS  1.3 ANSI |
| 2. Speeds and feed rates includes but  not limited to; | 2.1 Spindle speed  2.2 Crossfeed  2.3 Transverse feed  2.4 Vertical feed |
| 3. Cutting tools includes but not limited to; | 3.1 Side and Face  3.2 End mill  3.3 Slot  3.4 Gear  3.5 Boring tool  3.6 Fly |
| 4. Machining includes but not limited to; | 4.1 Slot cutting  4.2 Gear cutting  4.3 Boring  4.4 Face milling |
| 5. Specification includes but not limited to; | 5.1 Dimensions  5.2 Geometry  5.3 Surface finishing  5.4 Functionality |
| 6. Geometrical tolerance includes but not limited to; | 6.1 Flatness  6.2 Squareness  6.3 Straightness  6.4 Concentricity and roundness |
| 7. Attachments includes but not limited to; | 7.1 V- Blocks  7.2 Clamping device  7.3 Dividing heads  7.4 Indexing heads  7.5 Collets  7.6 Spindle  7.7 Arbor  7.8 Adaptor |

**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:

* Milling operations
* Measuring and marking
* Technical drawing
* Material testing
* Use of hand tools

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Occupational Health and Safety Act of Kenya laws 2007 with focus on personal safety, machine safety and workplace
* National Environment Management Authority Act, Kenya 2004
* OSH act
* Equipment manuals
* Technical drawing complyingto ISO, ANSI & BS standards
* Mathematics & science
* Physics and mechanics
* Metallurgy and materials
* Occupation heathy and safety
* Milling processes
* Inspection and testing
* CNC technology
* CAD/CAM
* 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:  1.1 Developed operation plan  1.2 Observed safety as per work place procedures  1.3 Calculated speed and feed rate  1.4 Selected cutting tools, speed & feed rates as per manufacturer‟s instructions  1.5 Inspected the product and specified tolerance and checked the finish  1.6 Housekeeping is observed before, during and after operations |
| 2. Resource Implications | 2.1 Milling machine  2.2 Cutting tools  2.3 Measuring tools  2.4 Stock material  2.5 Resource materials, manuals for cutting tools and milling |
| 3. Methods of  Assessment | Competency may be assessed through:  3.1 Observing the learner using the tools and equipment  3.2 Inspection of written operation procedure sheet 3.3 Quality control of the finished product with regards to the drawing specifications and tolerances  3.4 Observe the housekeeping and maintenance of tools and equipment |
| 4. Context of  Assessment | Competency may be assessed individually in the actual workplace or through accredited institution |
| 5. Guidance  information for assessment | Holistic assessment with other units relevant to the  Industry sector, workplace and job role is recommended. |

## PRODUCE PARTS BY SURFACE GRINDING

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

**UNIT DESCRIPTION:**

The learner will be introduced to use of technology involved in machining surface grinding as well as the general rules and methodology applied for setup and running of the grinding machine. Personal safety precaution, general safety, machine tool safety and work area safety are included in this unit.

**ELEMENTS AND PERFORMANCE CRITERIA**

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| **ELEMENT**  These describe the keyoutcomes which make up  workplace function | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements  ***(Bold and italicized terms are elaborated in the Range)*** |
| 1. Observe safety and regulations | 1.1 Prescribed personal safety gear is worn as per work place procedure.  1.2 Prescribed safety measures for the operation of hand tools and drilling machines adhered to as per rules and regulations  1.3 Prescribed safe work environment is observed as per rules and regulations  1.4 Prescribed workplace procedures are adhered to |
| 2.Identify parts of a grinder and their functions | 2.1 Types of grinders are identified  2.2 .Parts of a grinder are identified  2.3 Functions of a grinding machine are explained |

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| 3.Use grinding wheels and stones | 1. Types of grinding wheels/stones 2. Classification grinding wheels 3. Grinding wheel defects 4. Grinding wheels calculation and geometry 5. Wheel dressing 6. Wheel balancing 7. Wheel truing |
| 4.Use of coolant | 4.1 Types of coolants  4.2 Composition of coolants  4.3 Selection of coolants  4.4 Uses of coolants  4.5 Advantages/disadvantages of coolants  4.6 Handling of coolants |
| 5.Identify grinding operations | 1. Surface grinding 2. Internal grinding 3. Cylindrical grinding 4. Centre-less grinding 5. Special grinding processes |
| 1. Read and interpret working drawing | 1. Reading and extraction of information   (dimensions, tolerances, BS/ANSI Drawing Standards, geometric ISO symbols & abbreviations)   1. Development of operational plan |
| 1. Set up grinding machine | 1. Identifying grinding operation 2. Selecting and mounting grinding wheels/stones 3. Securing work piece 4. Selecting grinding speed and feed rate |
| 1. Produce ground parts | 8.1 Surface grinding  8.2 Internal grinding  8.3 Cylindrical grinding  8.4 Centre-less grinding  8.5. Special grinding processes |
| 1. Assess quality of ground parts | 9.1 Measuring/dimensional accuracy  9.2 Surface finish is checked  9.3 Functionality is checked |
| 10. Maintenance of grinding machine tool | 10.1 Grinding machine is cleaned  10.2 Grinding machine is serviced and maintained (lubrication, inspection, alignment  and adjustment) |
| 11. Performing housekeeping | 11.1 Work environment is cleaned (waste sorting  and disposal)  11.2 Tools and equipment are cleaned and stored  11.3 Grinding wheels/stones are stored |

**RANGE**

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

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| **VARIABLE** | **RANGE** |
| 1. Technical drawing Standards includes but not limited to; | 1.1 ISO  1.2 BS  1.3 ANSI |

**REQUIRED KNOWLEDGE AND SKILLS**

The individual needs to demonstrate the following skills

**Required Skills**

* Surface grinding
* Measuring and marking
* Technical drawing
* 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
* Equipment manuals
* Technical drawing complyingto ISO, ANSI & BS standards  Mathematics & science
* Physics and mechanics
* Metallurgy and materials
* Occupation heathy and safety
* Milling processes
* 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  1.1 Observed safety as per work place procedures  1.2 Developed an operation plan as per specifications  1.3 Calculated speed and feed rate  1.4 Selected speed & feed rates as per operation plan  1.5 Inspected the product and specified tolerances and checked finish  1.6 Work piece ground to specifications  1.7 Observed housekeeping before, during and after operations |
| 2. Resource Implications | 2.1 Surface grinder  2.2 Accessories for clamping  2.3 Dressing attachment  2.4 Grinding wheels  2.5 Measuring instruments  2.6 Inspection tools |
| 3. Methods of  Assessment | Competency may be assessed through:  3.1 The behaviour of the learner in the working environment  3.2 Measuring and visual inspection of finished work  piece  according to specifications  3.3 Observing the housekeeping and maintenance done by the  learner |
| 4. Context of  Assessment | Competency may be assessed individually in the actual workplace or through accredited institution |
| 5. Guidance information for assessment | Holistic assessment of other units relevant to the industry sector, workplace and job role is recommended. |

## PERFORM WORKSHOP PROCESSES

**UNIT CODE: ENG/OS/ME/CR/7/06/A**

**UNIT DESCRIPTION:**

This unit specifies the competencies required to perform workshop processes. It involves performing mechanical bench works, carrying out metal joining processes, operating lathe machines, operating milling machines, operating grinding machine, operating drilling and operating drilling machine. It also involves performing sheet metal works and foundry works.

**ELEMENTS AND PERFORMANCE CRITERIA**

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| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 1 Perform mechanical bench works | 1.1 Safe working habits are demonstrated according to OSHA 2007  1.2 Work station is prepared according to workshop procedures  1.3 Measuring and layout is performed according to the task  1.4 Materials are removed using ***hand tools*** according to the task  1.5 Hand tools are maintained and stored according workshop procedures. |
| 2 Perform forging operations | 2.1 Safe working habits are demonstrated according to OSHA 2007  2.2 Work station is prepared according to workshop procedures  2.3 Forging operations performed according to the task  2.4 Forging tools maintained and stored according workshop procedures. |

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| 1. Carry out metal joining processes | 3.1 Safe working procedures are observed according to OSHA 2007  3.2 Materials, tools and equipment are prepared according to the task  3.3 Mechanical fastenings are used according to job requirements  3.4 Metal riveting is carried out according to joining requirements  3.5 Soldering is carried out according to job requirements  3.6 Brazing is performed according to joining requirement  3.7 Adhesive bonding is carried out according to job requirements  3.8 Metal arc welding  3.9 Gas welding process is carried out according to joining requirements.  3.10 MIG and TIG welding process is carried out according to joining requirements.  3.11 Job quality is inspected according to working drawing specifications. |
| 1. Operate lathe machines | 4.1 Safety precautions are observed according to OSHA 2007  4.2 Operation plan is prepared according to working drawing.  4.3 Materials are prepared according engineering drawing  4.4 Lathe machines are selected according to work requirements  4.5 Cutting tools and lathe accessories are selected according to the task  4.6 Machine condition is checked according to manufacturer‟s manual  4.7 Work piece is set on the machine according to SOPs  4.8 Cutting tools are mounted on the machine according to SOPs  4.9 Machining parameters are calculated and set according to the work  4.10 Lathe machine operations are performed according to  job requirements  4.11 Work piece is inspected as per working drawing specifications  4.12 Cutting tools, lathe accessories and  environment are  cleaned and returned to store according to organizational policy  4.13 Job card is signed and work piece handed over to  consumer department according to organizational policy |

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| 1. Operate milling   machines | 5.1 Operation plan is prepared according to working drawing.  5.2 Materials are prepared according engineering drawing  5.3 ***Milling machines*** are selected according to work requirements  5.4 Cutting tools and ***milling accessories*** are selected according to the task  5.5. ***Machine condition*** is checked according to manufacturer‟s manual  5.6 Work piece is set on the machine according to SOPs  5.7 Cutting tools are mounted on the machine according to SOPs  5.8 Machining parameters are calculated and set according to the work  5.9 ***Milling machine operations*** are performed according to job requirements  5.9 Work piece is inspected as per working drawing  specifications  5.10 Cutting tools, milling accessories and environment are  cleaned and returned to store according to organizational  policy  5.11 Job card is signed and work piece handed over to consumer  department according to organizational policy |

|  |  |
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| 1. Operate grinding machine | 6.1 Operation plan is prepared according to working drawing.  6.2 Materials are prepared according engineering drawing  6.3 ***Grinding machines*** are selected according to work requirements  6.4 Cutting tools and ***grinding accessories*** are selected according to the task  6.5 Machine condition is checked according to manufacturer‟s manual  6.6 Work piece is set on the machine according to SOPs  6.7 Grinding wheels are mounted on the machine according to SOPs  6.8 Machining parameters are calculated and set according to the work  6.9 Work piece is inspected as per working drawing specifications  6.10 Grinding wheels, grinding accessories and environment are  cleaned and returned to store according to organizational  policy  6.11 Job card is signed and work piece handed over to consumer  department according to organizational policy |

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| 1. Operate drilling   machine | 7.1 Operation plan is prepared according to working drawing.  7.2 Materials are prepared according engineering drawing  7.3 ***Drilling machines*** are selected according to work requirements  7.4 Drilling bits and drilling accessories are selected according to the task  7.5 Machine condition is checked according to manufacturer‟s manual  7.6 ***Drilling Machine operations*** are performed according to job requirements  7.7 Work piece is set on the machine according to SOPs  7.8 Drill bits are mounted on the machine according to SOPs  7.9 Machining parameters are calculated and set according to the work  7.10 Work piece is inspected as per working drawing specifications  7.11 Drilling bits, drilling accessories and environment are  cleaned and returned to store according to organizational  policy  7.12 Job card is signed and work piece handed over to consumer  department according to organizational policy |

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| 8 Perform sheet metal works | 8.1 Safety precautions are observed according to  OSHA  8.2 Sheet metal materials are selected according to working drawing  8.3 Pattern is developed according to working drawing  8.4 Sheet metal work piece is cut according to working drawing  8.5 Sheet metal work piece is bent/rolled/folded/embossed/ /formed according to working drawing  8.6 Metal sheet product is fabricated according to engineering drawing  8.7 Fabricated product is inspected according to working drawing |
| 9 Perform non-  traditional manufacturin  g | 9.1 Safety precautions are observed according to  OSHA  9.2 materials are selected according to working drawing  9.3 material is machined using non-conventional methods |
| 10 Perform foundry works | 10.1 Safe working procedures are observed according to OSHA 2007  10.2 Molding patterns are produced according to |
|  | working drawing  10.3 Molds are produced as the pattern made  10.4 Metal materials are melted in a furnace according to SOPs ***Castings*** are produced according to working drawing  specifications  10.5 Castings are cleaned and inspected according to working drawing specifications |

**RANGE**

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

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| --- | --- |
| **VARIABLE** | **RANGE** |
| 1. Hand tools includes but not limited to; | 1.1 Chisel  1.2 Files  1.3 Scrappers  1.4 Hacksaw  1.5 Powered portable hand grinders  1.6 Powered portable hand drills |
| 2. Forging process includes but not limited to; | 2.1 Hearth  2.2 Swages  2.3 Hammers  2.4Tongs  2.5 Fullers |
| 3. Lathe machines includes but not limited to; | 3.1 Centre lathe  3.2 Turret and capstan lathe  3.3 CNC lathe |
| 4. Welding process includes but not limited to; | 4.1 TIG welding  4.2 MIG/MAG welding  4.3 Gas welding  4.4 Plasma welding  4.5 Spot welding |

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| 5. Lathe accessories includes but not limited to; | 5.1 Work holding devices – chucks  5.2 Steadies – fixed/movable  5.3 Centers |
| 6. Machine condition includes but not limited to; | 6.1 Cutting fluid  6.2 Oil levels  6.3 Greasing |
| 7. Machining parameters includes but not limited to; | 7.1 Cutting speeds  7.2 Depth of cut  7.3 Feed rate |
| 8. Lathe machine operations includes but not limited to; | 8.1 Facing  8.2 Turning  8.3 Knurling  8.4 Threading  8.5 Boring  8.6 Drilling  8.7 Taper turning  8.8 Parting off  8.9 Polishing  9.0 Part programming |
| 9. Milling machines includes but not limited to; | 9.1 CNC milling machine |
| 10. Milling accessories includes but not limited to; | 10.1 Dividing/indexing  10.2 Machine vice  10.3 Rotary tables  10.4 Helical milling attachment  10.5 Part programming |
| 11. Milling machine operations includes but not limited to; | 11.1 Plain milling  11.2 Cutting slots  11.3 Cutting splines  11.4 Gear cutting (Spur/ helical)  11.5 Cam milling |
|  | 11.6 Cutting sprockets  11.7 Milling injection molding cavities |
| 12. Grinding machines includes but not limited to; | Surface grinding machine  Cylindrical grinding machine  Center less grinding machine |
| 13. Drilling machines includes but not limited to; | Radial  Pillar  Sensitive |
| 14. Drilling Machine operations includes but not limited to; | Drilling  Reaming  Counter sinking  Counter boring  Spot facing |
| 15. Non-conventional machines includes but not limited to; | Abrasive jet machine Abrasive water jet machine  laser jet machine |
| 16. Abrasive jet machining parameters includes but not limited to; | Abrasive material Carrier gas nozzle |
| 17. Casting includes but not limited to; | Sand casting  Centrifugal casting  Investment casting  Die casting  Shell molding |

**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:

* Handling of cutting oil
* Casting processes
* Welding processes
* Lathe operations
* Milling operations
* Grinding operations
* Hand tools
* Metal sheet fabrication
* Heat treatment processes
* Metal sheet cutting
* Metal sheet folding/bending
* Forging operations
* CNC technology
* Non-conventional machining
* CAD/CAM

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Types of mechanical workshop layouts
* Workshop tools, equipment, materials and supplies
* Procurement procedures and legal regulations
* Maintenance procedures
* Relevant technical information
* Safe handling of workshop equipment and tools
* Mechanical workshop safety requirements
* Workshop policies
* Database management
* Workshop floor operations
* Management of storage facility
* Personal safety procedures
* Use of fire Extinguishers and prevention
* Storage/Disposal of Hazardous/flammable materials
* Positive Work Values (Perseverance, Honesty, Patience, Attention to Details)
* Basic management skills e.g. Planning, organizing, regulating, controlling and prioritization)

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:  1.1 Performed mechanical bench works  1.2 Performed forging work  1.3 Carried out metal joining processes  1.4 Operated lathe machines  1.5 Operated milling machines  1.6 Operated grinding machine  1.7 Operated drilling machine  1.8 Performed sheet metal works  1.9 Performed non-traditional machining  1.10Performed foundry works |
| 2. Method of assessment | Competency in this unit may be assessed through:  2.1 Written/Oral Questioning  2.2 Demonstration |
| 3. Context of assessment | 3.1 Competency must be assessed on the job or simulated environment.  3.2 The assessment of practical skills must take place after a period of supervised practice and repetitive experience. |
| 4. Resource implications | The following resources should be provided:  4.1 Workplace: Real or simulated work area  4.2 Appropriate Tools & equipment  4.4 Materials relevant to the activity |
| 5 Guidance  information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## MANAGE WORKSHOP PROCESSES

**UNIT CODE: ENG/ME/CR/8/06/A**

**UNIT DESCRIPTION:**

This unit specifies the competencies required to manage a motor vehicle workshop. It involves setting up and operationalizing of vehicle workshop, managing floor operations, tools, equipment and facilities. Storage of tools/ equipment and disposal of used materials are also incorporated in this competency

**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 Set up mechanical workshop | 1.1 Location site is determined as per service demand and availability of sufficient space  1.2 Workshop is designed and constructed according to OSHA  1.3 Workshop annual procurement plan is prepared in accordance with procurement policy  1.4 Workshop layout is determined as per ***scale of operations*** and flow of processes  1.5 ***Human resource plan*** is prepared in accordance with workshop operations and area of expertise  1.6 Storage facility is established as per the workshop standard requirement |
| 2 Operationalize mechanical workshop | 2.1 Timely acquisition and renewal of relevant licenses and subscription is undertaken in accordance with legal requirements  2.2 Human resource hired and managed based on human resource plan labor regulations  2.3 Procurement request is submitted and timely follow up on deliveries is made as per workshop requirements  2.4 Mechanical ***workshop tools, equipment, materials and supplies*** are procured based on procurement plan and scale of operation  2.5 Work plan schedule is prepared and implemented based on planned ***workshop operations*** |

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| 3 | Manage workshop floor operations | 3.1 Work environment is maintained neat, clean, safe and organized as per OSHA 2007 and workshop requirements  3.2 Work flow process guidelines and procedures are maintained and updated in accordance with company policy  3.3 Service and repair job cards and orders are approved in accordance with workshop regulations and customer specifications  3.4 Requests for spare parts, accessories and consumables are approved according to workshop requirements and procurement procedures  3.5 Timely insurance cover and renewals for the workshop including critical equipment and installations are undertaken in accordance with legal requirement  3.6 Workshop equipment and installation are maintained and optimally functional as per manufacturers specifications  3.7 Daily workshop operations, fuel consumptions and job production reports are reviewed as per SOPs. |

|  |  |
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| 4 Procure and control stock | 4.1 Workshop database system for agency online orders and stock level analysis are operated as per SOPs  4.2 Efficient and risk averse stock receipts, requisition, issue and monitoring system are maintained as per organization policy  4.3 Parts and consumables are procured stored safely, neatly and in an orderly manner as per workshop procedures  4.4 Maintain and update inventory of all workshop equipment, installation and assets in general in accordance with SOPs  4.5 Oversee monthly and annul stock taking of workshop stocks according to workshop requirements |
| 5 Oversee  plant maintenance | 5.1 Maintenance schedule is prepared according to manufacturer‟s manual.  5.2 Required maintenance personnel is identified as per task to be performed  5.3 Tools and equipment are identified according to task  5.4 Spare parts are procured/requested according to task/specifications  5.5 Maintenance job is supervised according organizational policy  5.6 Machine performance is verified according to manufacturer‟s manual. |
| 6 Maintain workshop database | 6.1 Computerized database and system is installed, updated and maintained in accordance with workshop requirements and organization policy  6.2 Machines ***spare parts*** and consumables records are updated as per the organization policy  6.3 Maintain a data base of all part codes and associated bar codes as well as part manuals and brochures  6.4 Maintain a list of fast and slow moving parts as well as dead stock according to the workshop requirements and organization requirements |

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| --- | --- |
| 7 Control workshop finance | 7.1 Workshop budget is prepared as per financial requirements  7.2 Workshop finances are sourced in accordance with organization policy  7.3 Workshop expenditure is monitored and controlled according to budget and workshop operations  7.4 Periodic financial reports are prepared as per workshop expenditure and organization requirements |
| 8 Manage workshop  storage facility | 8.1 Computerized store database system is established according to workshop requirements  8.2 Risk averse stock receipts, requisition, issue and monitoring system are maintained as per organization policy  8.3 Materials are issued according to job card requirements and stores regulations  8.4 Storage facility is maintained in accordance with workplace regulations and OSHA 2007 |
| 9 Organize scrap/dead stock disposal | 9.1 Dead stock/scrap disposal policy is developed in accordance with SOPs and OSHA 2007  9.2 Prepare scrap/dead stock for disposal as per the workshop regulations  9.3 Scrap/dead stock disposal site/mechanism is identified and located in accordance with standard operating procedure and OSHA 2007  9.4 Machine spare parts and consumables stock records are updated as per the workshop 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.

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| --- | --- |
| **Variable** | **Range** |
| 1. Scale of operations includes but not limited to; | Includes but not limited to:  1.1 Large scale operations  1.2 Medium level operations  1.3 Small scale operations |
| 2. Human resource plan includes but not limited to; | Includes but not limited to:  2.1 Recruitment  2.2 Appraisal  2.3 Training  2.4 Disciplinary actions  2.5 Remuneration |
| 3. Workshop tools, equipment, materials and supplies | Includes but not limited to:  3.1 Tool kits  3.2 Air compressor  3.3 Diagnostic machine |
| 4. Workshop operations includes but not limited to; | Includes but not limited to:  4.1 wearing of Personal protective equipment  4.2 Servicing/repairing  4.3 Lubrication  4.4 Welding  4.5 Cutting |
| 5. Spare parts includes but not limited to; | 5.1 Springs  5.2 Suspension bushes  5.3 Oil/fuel filters  5.4 Spark plugs  5.5 Suspension arms  5.6 Pistons  5.7 Fuel injectors |

**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:

* Handling of oils (Gear, oil, engine oil)
* Familiarization/Classification of Lubricants
* Lubrication Procedure
* Welding
* CNC technology
* CAD/CAM
* CNC Lathe operations
* CNC Milling processes
* Cutting operations
* Fitting

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Types of mechanical workshop layouts
* Workshop tools, equipment, materials and supplies
* Procurement procedures and legal regulations
* Service procedures
* Relevant technical information
* Safe handling of workshop equipment and tools
* Workshop safety requirements
* Workshop policies
* Database management
* Workshop floor operations
* Management of storage facility
* Personal safety procedures
* Use of fire Extinguishers and prevention
* Storage/Disposal of Hazardous/flammable materials
* Positive Work Values (Perseverance, Honesty, Patience, Attention to Details)
* Basic management skills e.g. Planning, organizing, regulating, controlling and prioritization)

**EVIDENCE GUIDE**

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

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| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:  1.1 Acquired and maintained relevant licenses and subscriptions in time  1.2 Prepared human resource plan and hired qualified personnel  1.3 Maintained work environment clean, safe and organized  1.4 Procured necessary workshop tools, equipment, materials and supplies as required in the workshop  1.5 Maintained workshop equipment and installations and ensured they operate optimally  1.6 Implemented work plan schedule appropriately  1.7 Maintained and updated work flow process guidelines and procedures  1.8 Approved service and repair job cards and orders  1.9 Reviewed daily workshop operations, fuel consumptions and job production reports  1.10 Maintained and updated inventory of all workshop equipment, installation and assets in general Computerized store database system is established according to workshop requirements  1.11 Prepared and implemented workshop budget as required  1.12 Installed, updated and maintained  Computerized database and systems  1.13 Prepared periodic financial reports as per workshop expenditure and organization requirements  1.14 Developed and implemented dead stock/scrap disposal policy  1.15 Disposed wastes and used lubricants/fluid as per required procedure  1.16 Maintained storage facility in accordance with workplace regulations and OSHA 2007 |

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| 2. Method of assessment | Competency in this unit may be assessed through:  2.1 Written/Oral Questioning  1.1 Demonstration |
| 3. Context of assessment | 3.1 Competency must be assessed on the job or simulated environment.  3.2 The assessment of practical skills must take place after a period of supervised practice and repetitive experience. |
| 4. Resource implications | The following resources should be provided:  4.1 Workplace: Real or simulated work area  4.2 Appropriate Tools & equipment  5.1 Materials relevant to the activity |
| 5. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |