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 **THE REPUBLIC OF KENYA**

**COMPETENCY BASED CURRICULUM**

**FOR**

**WELDING LEVEL 4**

**MANUAL METAL ARC WELDING AND GAS METAL ARC WELDING –**

**(MMAW AND GMAW -OPTION)**



 TVET CDACC

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 NAIROBI

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# FOREWORD

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

Reforms in the education sector are necessary for the achievement of Kenya Vision 2030 and meeting the provisions of the Constitution of Kenya 2010. The education sector had to be aligned to the Constitution and this resulted to the formulation of the Policy Framework for Reforming Education and Training. A key feature of this policy is the radical change in the design and delivery of the TVET training. This policy document requires that training in TVET be competency based, curriculum development be industry led, certification be based on demonstration of competence and mode of delivery allows for multiple entry and exit in TVET programmes.

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

It is my conviction that this curriculum will play a great role towards development of competent human resource for the Welding and Fabrication sector’s growth.

**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 on Reforming Education and Training in Kenya, emphasized the need to reform curriculum development, assessment and certification. This called for a 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.

TVET Curriculum Development, Assessment and Certification Council (TVET CDACC) in conjunction with Welding Sector Skills Advisory Committee (SSAC) have developed this curriculum.

This curriculum has been developed following the CBET framework policy; the CBETA standards and guidelines provided by the TVET Authority and the Kenya National Qualification Framework designed by the Kenya National Qualification Authority.

This curriculum is designed and organized with an outline of learning outcomes; Suggested Methods of Instruction, training/learning resources and methods of assessing the trainee’s achievement. The curriculum is competency-based and allows multiple entry and exit to the course.

 I am grateful to the Council members, Council Secretariat, Welding Sector Skills Advisory Committee (SSAC), expert workers and all those who participated in the development of this curriculum.

**CHAIRMAN, TVET CDACC**

# ACKNOWLEDGEMENT

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

I recognize with appreciation the role of the Welding Sector Skills Advisory Committee (SSAC) in ensuring that competencies required by the industry are addressed in the curriculum. I also thank all stakeholders in the Welding and Fabrication sector for their valuable input and all those who participated in the process of developing this curriculum.

I am convinced that this curriculum will go a long way in ensuring that workers in Welding and Fabrication sector acquire competencies that will enable them to perform their work more efficiently.

**COUNCIL SECRETARY/CEO**

**TVET CDACC**

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# ABBREVIATIONS AND ACRONYMS

BC Basic competency

CBET Competency Based Education and Training

CC Common competency

CR Core competency

CU Curriculum

ENG Engineering

KCSE Kenya Certificate of Secondary Education

KNQA Kenya National Qualifications Authority

OSH Occupational Safety and Health

PPE Personal Protective Equipment

TVET Technical and Vocational Education and Training

WEF Welding and Fabrication

KS Kenyan Standard

ISO International Organization for Standardization

BS British Standard

NEMA National Environmental Management Authority

ASME American Society of Mechanical Engineers

# KEY TO UNIT CODE

 ENG/CU/WEF/BC/01/4/A

Industry or sector

Curriculum

Occupational area

Type of competency

Competency number

Competency level

Version control

# COURSE OVERVIEW

Welding (MMAW and GMAW -option) level 4 qualification consists of competencies that a person must achieve to enable him/her to carry out various welding processes including manual metal arc welding, and Gas Metal Arc Welding (GMAW).

The units of learning comprising this qualification include the following basic, common and core competencies:

B**asic Units of learning**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Hrs.** | **No. of Credits** |
| ENG/CU/WEF/BC/01/4 | Communication skills  | 20  | 2 .0 |
| ENG/CU/WEF/BC/02/4 | Numeracy skills  | 25  | 2.5  |
| ENG/CU/WEF/BC/03/4 | Digital literacy  | 35  | 3.5  |
| ENG/CU/WEF/BC/04/4 | Entrepreneurial skills  | 60  | 6.0 |
| ENG/CU/WEF/BC/05/4 | Employability skills  | 30  | 30  |
| ENG/CU/WEF/BC/06/4 | Environmental literacy  | 20  | 20  |
| ENG/CU/WEF/BC/07/4 | Occupational safety and health practices  | 20  | 20  |
| **TOTAL** | **210** | **21.0** |

**Common Units of learning**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Hrs.** | **No. of Credits** |
| ENG/OS/WE/BC/01/4/A | Apply workplace essential skills | 30 | 3.0 |
| ENG/OS/WE/BC/02/4/A | Apply workshop concepts, tools and organization skills | 105 | 10.5 |
|  | **TOTAL**  | **135** | **13.5** |

**Core Units of learning**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Hrs.** | **No. of Credits** |
| ENG/CU/WEF/CR/01/4/A | Perform manual metal arc welding  | 80 | 8.0 |
| ENG/OS/WEF/CR/03/4/A | Perform Gas metal arc welding  | 80 | 8.0 |
|  | Industrial Attachment | **300** | **30.0** |
| **TOTAL** | **460** | **46.0** |
| **GRAND TOTAL** | **830** | **83.0** |

The total duration of the course is eight hundred and thirty (830) hours including 300 hours of industrial attachment

**Entry Requirements**

A trainee entering this course should have any of the following minimum requirements:

1. Kenya Certificate of Secondary Education (KCSE) mean grade E.

**Or**

1. Equivalent qualification as determined by Kenya National Qualifications Authority (KNQA).

**Industrial Attachment**

An individual enrolled in this course will undergo three hundred and sixty (360) hours industrial attachment in a welding and fabrication firm.

An individual enrolled in one of the core units of learning will undergo a forty (40) hours attachment.

**Trainer qualification**

A trainer for this course should have a higher qualification than the level of this course

**Assessment**

The course will be assessed at two levels: internal and external.

1. **Internal assessment**: conducted continuously by the trainer (internal assessor) who is monitored by an accredited internal verifier.
2. **External assessment**: conducted by an external assessor who is monitored by an accredited external verifier.

The assessors and verifiers are registered by TVET CDACC which also coordinates external assessment.

**Certification**

An individual will be awarded a Certificate of Competency on demonstration of competence in a unit of competency. To be awarded a National Certificate in Welding and Fabrication Level 4, an individual must demonstrate competence in all the units of competency as given in this qualification pack.

These certificates will be awarded by TVET CDACC in conjunction with the training provider.

**BASIC UNITS OF LEARNING**

# COMMUNICATION SKILLS

**UNIT CODE: ENG/CU/WEF/BC/01/4/A**

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate Communication Skills

**Duration of Unit:** 20 Hours

**Unit Description**

This unit covers the competencies required demonstrate communication skills. It involves obtaining and conveying workplace information, completing relevant work-related documents, communicating information about workplace processes, leading workplace discussion and communicating workplace issues.

**Summary of Learning Outcomes**

1. Obtain and convey workplace information
2. Complete relevant work-related documents
3. Communicate information about workplace processes
4. Lead workplace discussions
5. Identify and communicate issues arising in the workplace

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Obtain and convey workplace information
 | * Communication process
* Modes of communication
* Medium of communication
* Effective communication
* Barriers to communication
* Flow of communication
* Sources of information
* Types of questions
* Organizational policies
* Workplace etiquette
* Ethical work practices in handling communication
 | * Interview
* Third party reports
 |
| 1. Complete relevant work-related documents
 | * Types and purposes of workplace documents and forms
* Methods used in filling forms and documents
* Recording workplace data
* Process of distributing workplace forms and documents
* Report writing
* Types of workplace reports
 | * Interview
* Third party reports
 |
| 1. Communicate information about workplace processes
 | * Communication process
* Modes of communication
* Medium of communication
* Effective communication
* Barriers to communication
* Flow of communication
* Sources of information
* Organizational policies
* Organization requirements for written and electronic communication methods
* Report writing
* Effective questioning techniques (clarifying and probing)
* Workplace etiquette
* Ethical work practices in handling communication
 | * Interview
* Portfolio
 |
| 1. Lead workplace discussion
 | * Methods of discussion e.g.
	+ Coordination meetings
	+ Toolbox discussion
	+ Peer-to-peer discussion
* Solicitation of response
 | * Interview
* Third party reports
 |
| 1. Identify and communicate issues arising in the workplace
 | * Identification of problems and issues
* Organizing information on problems and issues
* Relating problems and issues
* Communication barriers affecting workplace discussions
 | * Interview
* Portfolio
 |

**Suggested Methods of Instruction**

* Direct instruction
* Demonstration
* Practice assignment
* Discussion
* Role play
* Brainstorming

**Recommended Resources**

* Desktop computers/laptops
* Internet connection
* Projectors
* Telephone
* Report writing templates

# NUMERACY SKILLS

**UNIT CODE:** **ENG/CU/WEF /BC/02/4/A**

**Relationship to Occupational Standards:**

This unit addresses the Unit of Competency: Demonstrate Numeracy Skills

**Duration of Unit:** 25hours

**Unit Description**

This unit covers the competencies required to demonstrate numeracy skills. It involves identifying and using whole numbers and simple fractions, decimals and percentages for work, identifying, measuring and estimating familiar quantities for work, reading and using familiar maps, plans and diagrams for work, identifying and describing common 2D and some 3D shapes for work, constructing simple tables and graphs for work using familiar data and identifying and interpreting information in familiar tables, graphs and charts for work.

**Summary of Learning Outcomes**

1. Identify and use whole numbers and simple fractions, decimals and percentages for work
2. Identify, measure and estimate familiar quantities for work
3. Read and use familiar maps, plans and diagrams for work
4. Identify and describe common 2D and some 3D shapes for work
5. Construct simple tables and graphs for work using familiar data
6. Identify and interpret information in familiar tables, graphs and charts for work

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Identify and use whole numbers and simple fractions, decimals and percentages for work
 | * Whole numbers
* Simple fractions
* Decimals
* Percentages
* Sizes
* Problem solving methods
* Calculations using the 4 operations
* Recording and communicating numerical information
 | * Written
* Practice assignments

  |
| 2. Identify, measure and estimate familiar quantities for work | * Measurement information
* Units of measurement
* Estimate familiar and simple amounts
* Selection of appropriate measuring equipment
* Calculate using familiar units of measurement
* Check measurements and results against estimates
* Using informal and some formal mathematical and general language
* Record or report results
 | * Written
* Practice assignments
 |
| 3. Read and use familiar maps, plans and diagrams for work | * Maps, plans and diagrams
* Locate items and places in familiar maps, plans and diagrams
* Recognize common symbols and keys in familiar maps, plans and diagrams
* Direction and location of objects, or route or places
* Use of informal and some formal oral mathematical language and symbols
 | * Practical test
* Written
 |
| 4. Identify and describe common 2D and some 3D shapes for work | * Common 2D shapes and 3D shapes
* Classification of common 2D shapes and designs
* Description of Use informal and some formal language to describe common two-dimensional shapes and some common three-dimensional shapes
* Construction of common 2D shapes
* Match common 3D shapes to their 2D sketches or nets
 | * Written
* Practical test
 |
| 5. Construct simple tables and graphs for work using familiar data | * Types of graphs
* Determination of data to be collected
* Selection of data collection method
* Collection of data
* Determination of variables from the data collected
* Order and collate data
* Construct a table and enter data
* Construct a graph using data from table
* Check results
* Report or discuss graph information related to work using informal and some formal mathematical and general language
 | * Written
* Practical test
 |
| 6. Identify and interpret information in familiar tables, graphs and charts for work | * Tables construction and labeling
* i.e. title, headings, rows and columns
* Interpreting information and data in simple tables
* Relaying information of relevant workplace tasks on/in a table
* Identify familiar graphs and charts in familiar texts and contexts
* Locate title, labels, axes, scale and key from familiar graphs and charts
* Identify and interpret information and data in familiar graphs and charts
* Relate information to relevant workplace tasks
 | * Written
* Practical test
 |

**Suggested Methods of Instruction**

* Instructor led facilitation of theory
* Practical demonstration of tasks by trainer
* Practice by trainees/ role play
* Discussion
* Observations and comments and corrections by trainers

**Recommended Resources**

* Computers
* Stationery
* Charts
* Video clips
* Audio tapes
* LCD projectors
* Standard operating and/or other workplace procedures manuals
* Specific job procedures manuals
* Projectors
* Writing boards
* Mathematical tables

# DIGITAL LITERACY

**UNIT CODE: ENG/CU/WEF/BC/03/4/A**

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate Digital Literacy

**Duration of Unit:** 35 hours

**Unit Description**

This unit covers the competencies required to demonstrate digital literacy in a working environment. It entails identifying computer software and hardware, applying security measures to data, hardware, software, applying computer software in solving task sand applying internet and email in communication at workplace.

**Summary of Learning Outcomes**

1. Identify computer software and hardware
2. Apply security measures to data, hardware and software
3. Apply computer software in solving tasks
4. Apply internet and email in communication at workplace

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Identify computer hardware and software
 | * Meaning of a computer
* Functions of a computer
* Components of a computer
* Classification of computers
 | * Written tests
* Oral
* Observation
 |
| 1. Apply security measures to data, hardware and software
 | * Data security and control
* Security threats and control measures
* Types of computer crimes
* Detection and protection against computer crimes
 | * Written tests
* Oral presentation
* Observation
* Projects
 |
| 1. Apply computer software in solving tasks
 | * Operating system
* Word processing
* Spread sheets
* Data base
 | * Oral questioning
* Observation
* Project
 |
| 1. Apply internet and email in communication at workplace
 | * Computer networks
* Uses of internet
* Electronic mail (e-mail) concept
 | * Oral questioning
* Observation
* Oral presentation
* Written report
 |

**Suggested Methods of Instruction**

* Instructor led facilitation of theory
* Demonstration by trainer
* Practical assignment
* Viewing of related videos
* Project
* Group discussions

**Recommended Resources**

* Desktop computers
* Laptop computers
* Other digital devices
* Printers
* Storage devices
* Internet access
* Computer software

# ENTREPRENEURIAL SKILLS

**UNIT CODE: ENG/CU/WEF/BC/04/4/A**

**Relationship to occupational standards**

This unit addresses the Unit of Competency: Demonstrate Entrepreneurial Skills

**Duration of unit:** 60 hours

**Unit description**

This unit covers the competencies required for creating and maintaining small scale business, establishing small business customer base, managing and growing a micro/small-scale business.

**Summary of Learning Outcomes**

1. Create and maintain small scale business
2. Establish small scale business customer base
3. Manage small scale business
4. Grow/expand small scale business

 **Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Create and maintain small scale business
 | * Starting a small business
* Legal regulatory requirements in starting a small business
* SWOT/ PESTEL analysis
* Conducting market/industry survey
* Generation and evaluation of business ideas
* Matching competencies with business opportunities
* Forms of business ownership
* Location of a small business
* Legal and regulatory requirement
* Resources required to start a small business
* Common terminologies in entrepreneurship
* Entrepreneurship in national development
* Self-employment
* Formal and informal employment
* Entrepreneurial culture
* Myths associated with entrepreneurship
* Types, characteristics, qualities & role of entrepreneurs
* History, development and importance of entrepreneurship
* Theories of entrepreneurship
* Quality assurance for small businesses
* Policies and procedures on occupational safety and health and environmental concerns
 | * Individual/group assignments
* projects
* Written
* Oral
 |
| 1. Establish small scale business customer base
 | * Good staff/workers and customer relations
* Marketing strategy
* Identifying and maintain new customers and markets
* Product/ service promotions
* Products / services diversification
* SWOT / PESTEL analysis
* Conducting a business survey
* Generating Business ideas
* Business opportunities
 | * Individual/group assignments
* projects
* Written
* Oral
 |
| 1. Manage small scale business
 | * Organization of a small business
* Small business’ business plan
* Marketing for small businesses
* Managing finances for small business
* Production/ operation process for goods/services
* Small business records management
* Book keeping and auditing for small businesses
* Business support services
* Small business resources mobilization and utilization
* Basic business social responsibility
* Management of small business
* Word processing concepts in small business management
* Computer application software
* Monitoring and controlling business operations
 | * Oral
* Individual/group assignments
* projects
* Written
 |
| 1. Grow/expand small scale business
 | * Methods of growing small business
* Resources for growing small business
* Small business growth plan
* Computer software in business development
* ICT and business growth
 | * Individual/group assignments
* projects
* Written
 |

**Suggested Methods of Instruction**

* Instructor led facilitation of theory
* Demonstration by trainer
* Practice by trainee
* Role play
* Case study

**Recommended Resources**

* Case studies for small businesses
* Business plan templates
* Lap top/ desk top computer
* Internet
* Telephone
* Writing materials

## EMPLOYABILITY SKILLS

**UNIT CODE:** **ENG/CU/WEF**/**BC/05/4/A**

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate Employability Skills

**Duration of Unit:** 30 hours

**Unit Description**

This unit covers competencies required to demonstrate employability skills. It involves conducting self-management, demonstrating critical safe work habits, demonstrating workplace learning and workplace ethics.

**Summary of Learning Outcomes**

1. Conduct self-management
2. Demonstrate critical safe work habits
3. Demonstrate workplace learning
4. Demonstrate workplace ethics

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Conduct self-management
 | * Self-awareness
* Formulating personal vision, mission and goals
* Strategies for overcoming life challenges
* Emotional intelligence
* Assertiveness
* Expressing personal thoughts, feelings and beliefs
* Developing and maintaining high self-esteem
* Developing and maintaining positive self-image
* Articulating ideas and aspirations
* Accountability and responsibility
* Good work habits
* Self-awareness
* Self-development
* Financial literacy
* Healthy lifestyle practices
 | * Written tests
* Oral questioning
* Portfolio of evidence
* Third party report
 |
| 1. Demonstrate critical safe work habits
 | * Stress and stress management
* Punctuality and time consciousness
* Interpersonal communication
* Sharing information
* Leisure
* Integratingpersonal objectives into organizational objectives
* Resources utilization
* Setting work priorities
* HIV and AIDS
* Drug and substance abuse
* Handling emerging issues
 | * Written tests
* Oral questioning
* Portfolio of evidence
* Third party report
 |
| 1. Demonstrate workplace learning
 | * Personal training needs identification and assessment
* Managing own learning
* Contributing to the learning community at the workplace
* Cultural aspects of work
* Variety of learning context
* Application of learning
* Safe use of technology
* Identifying opportunities
* Workplace innovation
* Performance improvement
* Handling emerging issues
* Future trends and concerns in learning
 | * Written tests
* Oral questioning
* Portfolio of evidence
* Third party report
 |
| 1. Demonstrate workplace ethics
 | * Meaning of ethics
* Ethical perspectives
* Principles of ethics
* Values and beliefs
* Ethical standards
* Organization code of ethics
* Common ethical dilemmas
* Organization culture
* Corruption, bribery and conflict of interest
* Privacy and data protection
* Diversity, harassment and mutual respect
* Financial responsibility/accountability
* Etiquette
* Personal and professional integrity
* Commitment to jurisdictional laws
* Emerging issues in ethics
 | * Written tests
* Oral questioning
* Portfolio of evidence
* Third party report
 |

**Suggested Methods of Instruction**

* Simulation/Role play
* Group Discussion
* Presentations
* Q&A
* Case studies
* Assignments

**Recommended Resources**

* Computers
* Stationery
* Charts
* Video clips
* Audio tapes
* Radio sets
* TV sets
* LCD projectors

# ENVIRONMENTAL LITERACY

**UNIT CODE: ENG/CU/WEF/BC/06/4/A**

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate Environmental Literacy

**Duration of Unit:** 20hours

**Unit Description**

# This unit specifies the competencies required to demonstrate environmental literacy. It involves controlling environmental hazard, controlling environmental pollution, demonstrating sustainable resource use and evaluating current practices in relation to resource usage.

**Summary of Learning Outcomes**

1. Control environmental hazard
2. Control environmental pollution
3. Demonstrate sustainable use of resources
4. Evaluate current practices in relation to resource usage

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Control environmental hazard
 | * Purposes and content of Environmental Management and Coordination Act 1999
* Purposes and content of Solid Waste Act
* Storage methods for environmentally hazardous materials
* Disposal methods of hazardous wastes
* Types and uses of PPE in line with environmental regulations
* Occupational Safety and Health Standards (OSHS)
 | * Written tests
* Oral questions
* Observation of work procedures
 |
| 1. Control environmental Pollution
 | * Types of pollution
* Environmental pollution control measures
* Types of solid wastes
* Procedures for solid waste management
* Different types of noise pollution
* Methods for minimizing noise pollution
 | * Written tests
* Oral questions
* Observation of work procedures
* Role play
 |
| 1. Demonstrate sustainable resource use
 | * Types of resources
* Techniques in measuring current usage of resources
* Calculating current usage of resources
* Methods for minimizing wastage
* Waste management procedures
* Principles of 3Rs (Reduce, Reuse, Recycle)
* Methods for economizing or reducing resource consumption
 | * Written tests
* Oral questions
* Observation of work procedures
 |
| 1. Evaluate current practices in relation to resource usage
 | * 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 of current work processes to access information and data
* Identification of areas for improvement
 | * Written tests
* Oral questions
* Observation of work procedures
 |
| 1. Identify Environmental legislations/conventions for environmental concerns
 | * Environmental issues/concerns
* Environmental legislations /conventions and local ordinances
* Industrial standard /environmental practices
* International Environmental Protocols (Montreal, Kyoto)
* Features of an environmental strategy
 | * Written tests
* Oral questions
* Observation of work procedures
 |

**Suggested Methods of Instruction**

* Instructor led facilitation of theory
* Practical demonstration of tasks by trainer
* Practice by trainees/ role play
* Discussion
* Observations and comments and corrections by trainers

**Recommended Resources**

* Computers
* Stationery
* Charts
* Video clips
* Audio tapes
* Radio sets
* TV sets
* LCD projectors
* Standard operating and/or other workplace procedures manuals
* Specific job procedures manuals
* Machine/equipment manufacturer’s specifications and instructions
* Personal Protective Equipment (PPE)

# OCCUPATIONAL SAFETY AND HEALTH PRACTICES

**UNIT CODE: ENG/CU/WEF**/**BC/07/4/A**

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Demonstrate Occupational Safety and Health Practices

**Duration of Unit:** 20 hours

**Unit Description**

This unit specifies the competencies required to practice safety and health and comply with OSH requirements relevant to work. It involves adhering to workplace procedures for hazards and risk prevention and participating in arrangements for workplace safety and health maintenance.

**Summary of Learning Outcomes**

1. Adhere to workplace procedures for hazards and risk prevention
2. Participate in arrangements for workplace safety and health maintenance

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment****Methods** |
| 1. Adhere to workplace procedures for hazards and risk prevention
 | * Arrangement of work area and items in accordance with Company housekeeping procedures
* Adherence to work standards and procedures
* Application of preventive and control measures, including use of safety gears/PPE
* Study and apply standards and procedures for incidents and emergencies.
 | * Oral questions
* Written tests
* Portfolio of evidence
* Third party report
 |
| 1. Participate in arrangements for workplace safety and health maintenance
 | * Participating in orientations on OSH requirements/regulations of tasks
* Providing feedback on health, safety, and security concerns to appropriate personnel as required in a sufficiently detailed manner
* Practice workplace procedures for reporting hazards, incidents, injuries and sickness
* OSH requirements/ regulations and workplace safety and hazard control procedures are reviewed, and compliance reported to appropriate personnel
* Identification of needed OSH-related trainings are proposed to appropriate personnel
 | * Oral questions
* Written tests
* Portfolio of evidence
* Third party report
 |

**Suggested Methods of Instruction**

* Assigments
* Discussion
* Q&A
* Role play
* Viewing of related videos

**Recommended Resources**

* Computers
* Stationery
* Charts
* Video clips
* Audio tapes
* Radio sets
* TV sets
* LCD projectors
* Standard operating and/or other workplace procedures manuals
* Specific job procedures manuals
* Machine/equipment manufacturer’s specifications and instructions
* Personal Protective Equipment (PPE) e.g.
* Mask
* Face mask/shield
* Safety bootsn
* Safety harness
* Arm/Hand guard, gloves
* Eye protection (goggles, shield)
* Hearing protection (ear muffs, ear plugs)
* Hair Net/cap/bonnet
* Hard hat
* Face protection (mask, shield)
* Apron/Gown/coverall/jump suit
* Anti-static suits
* High-visibility reflective vest

**COMMON UNITS OF LEARNING**

**APPLY WORKPLACE ESSENTIAL SKILLS**

**Unit Code: ENG/CU/WEF/CC/01/4/A**

**Relationship to Occupational Standards**

This unit addresses the unit standard: Apply workplace essential skills

**Duration of Unit:** 30 hours

**Unit Description**

This unit of competency has been designed for people who wish to enter paid employment or self-employment in a variety of contexts. It specifies the competencies required to: Follow principles of work ethics; Resolve conflict with others; Demonstrate effective speaking and listening skills; Read and interpret work document; Interact with team members; and Perform individual role in a team.

**Summary of Learning Outcomes**

1. Demonstrate work ethics and conflict resolutions
2. Demonstrate effective speaking and listening skills
3. Demonstrate communication skills and teamwork participation

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Demonstrate work ethics and conflict resolutions
 | * Meaning of work ethics
* Importance of work ethics and principles including, but not limited to:
* Honesty
* Selflessness
* Consistency
* Moral
* Courage
* Respect
* Work ethics in organizations
* Punctuality
* Work preparation
* Team work
* Delivery/ productivity
* Innovation, etc.
* Purpose of work ethics to an organization
* Organizational image branding
* Instilling confidence
* Maintaining relations with the general public
* Conflict and conflict resolution
* Define conflict
* Causes of conflict
* Resolution techniques
* Procedures for conflict resolution
* organization’s regulations and policies
 | * Oral questions
* Written tests
* Observation
* Role play
 |
| 1. Demonstrate effective speaking and listening skills
 | * Language variations in different contexts
* Social interactions
* Work interactions
* Facial expressions and gestures
* Ways of asking for;
* Information
* Making offers
* Commanding
* Pronunciations and expression of emotions
 | * Role plays
* Site or field visits
* Group interactions
* Simulation
* Written assessments
* Oral assessments
* Observation
 |
| 1. Demonstrate communication skills and teamwork participation
 | * Active listening
* Use of intonation
* Formulate open and closed questions appropriate to the context
* Use of comments or questions to expand on ideas
* Use of interaction skills
* Initiating topics
* Making positive statements
* Voicing disagreement in an appropriate manner
* Speaking clearly and varying tone
* Volume and pace appropriately
* Use of work documents
* Work plans
* Charts
* Job cards
* Maps
* Work schedule/procedures
* Job safety analysis
* Safety manuals
* Lift plans, etc.
* Storage and retrieval of work documents
* Team members and individual roles
* Features of effective teamwork
* Strengths and weaknesses of working in teams
* Providing assistance to individual team members
 | * Role plays
* Site or field visits
* Group interactions
* Simulation
* Written assessments
* Oral assessments
* Observation
 |

**Suggested Methods of Instruction**

* Instructor led facilitation of theory
* Group and individual activities
* Practical demonstration of task
* Guided practice by learners
* Self-paced learning

**Recommended Resources**

* Standard operating and/or other workplace procedures manuals
* Specific job procedures manuals
* Audio and video on team work, conflict resolutions

WORKSHOP CONCEPTS, TOOLS AND ORGANIZATION SKILLS

**UNIT CODE: ENG/CU/WEF/CC/02/4/A**

**Relationship to Occupational Standards**

This unit addresses the unit standard: Apply general engineering concepts and tools

**Duration of Unit:** 105 hours

**Unit Description**

This unit of competency specifies the skills required for a worker in application of workshop tools, welding drawings, basic welding measurements and mensuration. It also includes competencies: Apply time management techniques; Apply quality improvement measures; and apply productivity improvement measures.

**Summary of Learning Outcomes**

1. Apply workshop tools and equipment.
2. Perform basic measurements and calculations.
3. Interpret drawings and specifications.
4. Implement time management plan.
5. Apply work and productivity improvement measures.

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Apply workshop tools and equipment
 | * Classification of tools
* Hand-operated tools
* Power-operated tools.
* Bench and hand tools
* Use of tools
* Striking tools e.g. hammers
* Work holding tools e.g. vices, clamps
* Cutting tools e.g. hacksaw, files, chisel, scrapers, cut off grinders, etc.
* Care and maintenance of tool
* Instructional manuals
* Inspection e.g. cleanliness, condition, removable parts, models and serial numbers/Codes
* Faulty in tools e.g. exposed electrical wires, loose fittings, broken parts, worn out.
* Effect of mishandling tools e.g. breakage, power surge/blow out, injury to personnel, poor job/work output
* Tools maintenance checklist
* Tools Issuance and control
 | * Oral questions
* Written tests
* Observation
* Project
 |
| 1. Perform basic measurements and calculations
 | **Measurements and Calculations** * Computed basic mathematical operations
* Solved fractions and ratios problems
* SI units and Conversions of measurements
* Basic calculations on measuring tools and equipment.
* Mensuration.

**Workshop Tools** * Classification of measuring instruments
* Precision e.g. Vernier
* Non-precision e.g. steel rule
* Linear and angular measuring instruments.
* Marking out tools
* Methods of marking out
* Use of measuring instruments
* Linear and angular
* Inspection and checking tools.
* Measuring and inspection errors
* Errors due human errors
* Errors due to faulty instruments
* Measuring instruments maintenance
 | * Oral questions
* Written tests
* Observation
* Project
 |
| 1. Interpret drawings and specifications
 | * Drawing tools and materials
* Scales
* Conversion of scale and dimensions
* Drawing symbols and welding symbols
* Types of projections
* 1st angle
* 3rd angle
* Interpretation of drawing
* Free hand sketching
 | * Oral questions
* Written tests
* Observation
* Project
 |
| 1. Implement time management plan
 | * Work activities breakdown
* Tasks prioritization measures
* Prioritization checklist
* Importance of work plan
* Features of a work plan
* Preparation of work plan
* Work plan execution checklist
 | * Oral questions
* Written tests
* Observation
* Role play
 |
| 1. Apply work and productivity improvement measures
 | * Define production
* Types of productions
* Mass production
* Line production
* Importance of production goals
* Application of production schedules and job card requirements
* Production improvement interventions
 | * Oral questions
* Written tests
* Observation
 |

**Suggested Methods of Instruction**

* Instructor led facilitation of theory
* Group and individual activities
* Practical demonstration of task
* Guided practice by learners
* Self-paced learning

**Recommended Resources**

* Calculators
* Rulers, pencils, erasers
* Assorted workshop tools
* Viewing video of safe use of hand-operated tools
* Viewing video of safe use of power-operated tools
* Sample of engineering drawings
* Standard operating and/or other workplace procedures manuals
* Specific job procedures manuals
* Audio and video on team work, conflict resolutions
* Assorted work plans
* Sample production-monitoring checklists etc.

# CORE UNITS OF LEARNING

# MANUAL METAL ARC WELDING

**UNIT CODE: ENG/OS/WEF/CR/01/4/A**

**Unit Title:** Perform Manual Metal Arc welding

**Relationship to Occupational Standards**

This unit addresses the unit standard: Perform manual arc welding

**Duration of Unit:** 80 hours

**Unit Description**

This unit of competency specifies skills required in carrying out manual metal arc welding operations in all positions. These include competencies in setting up and carrying out welding tasks while observing welding safety. It is also known as Shielded Metal Arc Welding (SMAW).

**Summary of Learning Outcomes**

1. Set up MMA equipment and materials
2. Carry out MMA welding

**Learning Outcomes, Specific Learning Outcomes and Content**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Set up MMA equipment and materials
 | * Safety in welding workshop
* Workplace safety
* Welding area safety – checklist
* Workplace housekeeping (before, during and after working) - workstation cleaning, care and storage of tools and equipment, and waste disposal
* Materials, tools and equipment

Materials * Carbon steels, cast iron, stainless steel, and aluminium and alloy steels and tool steel

Uses different types of electrodes* Electrodes for welding carbon steels,
* Electrodes for welding aluminium
* Electrodes for welding stainless steel
* Electrodes for welding cast iron

Tools and equipment* Tools essential in welding works
* MMA equipment
* MMA accessories
* Steps of setting up MMA equipment
* Joint geometry preparation
* Butt, Square, etc.
 | * Observation checklist
* Oral questioning
* Written tests
* Product checklist
 |
| 1. Carry out MMA welding
 | * Current setting
* Material type and thickness
* Electrode type and size
* Workpiece positions i.e. in down-hand, vertical and overhead
* Safety in MMA welding
* Welding polarity
* DC; DC positive and DC negative
* AC
* Striking an arc
	+ Scratching
	+ Tapping
* Factors affecting quality of weld
	+ Arc length
	+ Travel speed
	+ Current setting
	+ Angle of electrode
* MMA welding
* Carbon steels
* Stainless
* Aluminium
* Alloy steel
* Cast iron
* Tool steel
* Welding patterns
* MMA welding defects, causes and remedies
* Dressing
* Applications of MMA welding in all positions.
 | * Observation checklist
* Product checklist
* Oral questioning
* Written tests
* Project checklist
 |

**Suggested Methods of Instruction**

* Facilitation of theory by trainer
* Demonstration of tasks by trainer
* Practice by trainee
* Viewing videos of MMA welding
* Viewing welding simulations
* Industrial visits

**Recommended Resources**

* Personal Protective Equipment
* Welding overall/ apron
* MMA welding shades/lens and goggles
* Special fire proof head cap
* Safety boots
* MMA welding gloves
* Ear safety devices
* Welding bay/welding booth
* MMA welding tools, equipment and accessories
* Welding materials
* Welding electrodes
* Video clips on MMA welding etc.

PERFORM GAS METAL ARC WELDING

**UNIT CODE: ENG/CU/WEF/CR/02/4/A**

**Relationship to Occupational Standards**

This unit of learning addresses the unit of competency: Perform gas metal arc welding (GMAW)

**Duration of Unit:** 80 hours

**Unit Description**

This unit of competency is designed to equip a trainee with skills required to prepare welding work, set up and carry out gas metal arc welding (GMAW) while observing safety. GMAW is known as metal inert gas (MIG) when an inert gas is used for shielding. It also known as metal active gas (MAG) when an active gas is used for shielding.

**Summary of Learning Outcomes**

1. Set up GMAW equipment and materials
2. Carry out GMAW welding

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Set up GMAW equipment and materials
 | * Safety in welding workshop
* Workplace safety
* Welding area safety – checklist
* Workplace housekeeping (before, during and after working - workstation cleaning)
* Care and storage of tools and equipment, and waste disposal
* Materials, tools and equipment
* Materials

Tools and equipment* Tools essential in welding works
* Constructional features of GMAW equipment
* GMAW accessories
* Steps of setting up GMAW equipment
* Joint geometry preparation
* Butt, Square, etc.
 | * Observation checklist
* Oral questioning
* Written tests
* Product checklist
 |
| 1. Carry out GMAW welding
 | * GMAW process and safety
* MIG/MAG Power sources (DC)
* Selection of wire type and size
* Wire feed mechanism and proper operation
* Shielding gases
* Argon
* Carbon dioxide (CO2)
* Modes of metal transfer
* Short circuit
* Globular
* Spray
* Factors affecting quality of weld:
	+ Distance contact tube/ workpiece
	+ Travel speed
	+ Gas flow rate
	+ Current setting/amperage
	+ Angle of welding gun
* Arc welding carbon steels and stainless steel
* GMAW defects, causes and remedies
* Application of GMAW
 | * Observation checklist
* Product checklist
* Oral questioning
* Written tests
* Project checklist
 |

**Suggested Methods of Instruction**

* Facilitation of theory by trainer
* Demonstration of task by trainer
* Practice by trainee
* Viewing videos of GMAW welding processes
* Viewing simulation of GMAW processes
* Industrial visits

**Recommended Resources**

* Personal Protective Equipment
* Welding overall/ apron
* GMAW welding shades and goggles
* Special fire proof head cap
* Safety boots
* GMAW welding gloves
* Ear safety devices
* Welding bay/welding booth
* GMAW welding tools, equipment and accessories
* Welding materials
	+ Mild steel
	+ Stainless steel
	+ Video clips on MIG/MAG welding