

**REPUBLIC OF KENYA**

**COMPETENCY BASED CURRICULUM**

**FOR**

**MECHANICAL PRODUCTION (LATHE AND FABRICATION) LEVEL 4**



TVET CDACC

P.O BOX 15745-00100

NAIROBI

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**FOREWORD**

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

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

These reforms demand that Industry takes a leading role in Curriculum development to ensure the Curriculum addresses its competence needs. It is against this background that 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 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 on Reforming Education and Training in Kenya, emphasized the need toreform 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 labour force.

TVET Curriculum Development, Assessment and Certification Council (TVET CDACC), in conjunction with Mechanical Engineering 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 delivery methods, 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, Mechanical engineering 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 Mechanical Engineering Sector Skills Advisory Committee (SSAC) in ensuring that competencies required by the industry are addressed in the Curriculum. I also thank all stakeholders in Mechanical Engineering 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 Mechanical Sector acquire competencies that will enable them to perform their work more efficiently.

**COUNCIL SECRETARY/CEO**

**TVET CDACC**

**ACRONYMNS AND ABBREVIATIONS**

CDACC Curriculum Development, Assessment and Certification Council

OSHA Occupational Safety and Health Act

PPE Personal Protective Equipment

TVET Technical and Vocational Education and Training

SOP Standard operating procedure

WIBA Work injury benefits Act

ENG Engineering

OS Occupational Standards

CU Curriculum

ME Mechanical Engineering

BC Basic Competencies

CC Common Competencies

CR Core Competencies

B Control Version

**KEY TO UNIT CODE**

ENG/CU/MLF/BC/01/4/B

Industry or sector

Curriculum

Occupational area

Type of competency

Competency number

Competency level

Control version

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**OVERVIEW**

**Description of the course**

Mechanical production (Lathe and fabrication) Level 4 qualification consists of competencies that a person must achieve to enable him/her to be certified as a lathe and fabrication artisan.

A Mechanical production (Lathe and fabrication) artisan is a person who will carry out Lathe and fabrication duties using a given design and customer’s requirements. This work demands the artisan to read and interpret drawings in mechanical production sector so that he/she can fabricate and produce components on a lathe machine according to the national and international standards.

The course consists of basic, common and core units of learning as indicated below:

**Basic Units of Learning**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Duration in Hours** | **Credit Factors** |
| ENG/CU/MLF/BC/01/4/B | Communication skills | 20 | 2 |
| ENG/CU/MLF/BC/02/4/B | Numeracy skills | 25 | 3 |
| ENG/CU/MLF/BC/03/4/B | Digital Literacy | 35 | 3.5 |
| ENG/CU/MLF/BC/04/4/B | Entrepreneurial skills | 60 | 6 |
| ENG/CU/MLF/BC/05/4/B | Employability skills | 30 | 3 |
| ENG/CU/MLF/BC/06/4/B | Environmental literacy | 20 | 2 |
| ENG/CU/MLF/BC/07/4/B | Occupational safety and health practices | 20 | 2 |
| **Total** | | **210** | **21** |

**Common Units of Learning**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Duration in Hours** | **Credit Factors** |
| ENG/CU/MLF/CC/01/4/B | Basic technical drawing | 100 | 10 |
| ENG/CU/MLF/CC/02/4/B | Metallic and non-metallic materials | 60 | 6 |
| ENG/CU/MLF/CC/03/4/B | Bench work operations | 100 | 10 |
| **Total** | | **260** | **26** |

**Core Units of Learning**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Duration in Hours** | **Credit Factors** |
| ENG/CU/MLF/CR/01/4/B | Sheet metal fabrication | 150 | 15 |
| ENG/CU/MLF/CR/02/4/B | Lathe machine operations | 150 | 15 |
| ENG/CU/MLF/CR/03/4/B | Industrial Attachment | 300 | 30 |
| **Total** | | **600** | **60** |
| **Grand Total** | | **1070** | **107** |

The core units of learning are independent of each other and may be taken independently.

The total duration of the course is **1070** (29 weeks at 30 hours per week) inclusive of industrial attachment.

**Entry Requirements**

An individual entering this course should have any of the following minimum requirements:

1. Kenya Certificate of Secondary Education (K.C.S.E.) grade E

**Or**

1. Level 3 certificate in related course with **one** year of continuous work experience

**Or**

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

**Trainer qualification**

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

**Industrial attachment**

An individual enrolled in this course will be required to undergo an industrial attachment in a Mechanical Engineering firm for a period of at least 300 hours. Attachment will be undertaken upon completion of the course or the unit of learning.

**Assessment**

The course will be assessed at two levels: internally and externally. Internal assessment is continuous and is conducted by the trainer who is monitored by an internal accredited verifier while external assessment is the responsibility of TVET/CDACC.

**Certification**

A candidate will be issued with a Certificate of Competency on demonstration of competence in a unit of competency. To attain the qualification Mechanical production (Lathe and Fabrication) Level 4, the candidate must demonstrate competence in all the units of competency as given in qualification pack. These certificates will be issued by TVET CDACC in conjunction with training provider.

**BASIC UNITS OF LEARNING**

## COMMUNICATION SKILLS

**UNIT CODE: ENG/CU/MLF/BC/01/4/B**

**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/MLF/BC/02/4/B**

**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 Tests * 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 Tests * 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 Tests |
| 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 Tests * 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 Tests * 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 Tests * 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/MLF/BC/03/4/B**

**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 Questioning * 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/MLF/BC/04/4/B**

**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 Tests * Oral Questioning |
| 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 Tests * Oral Questioning |
| 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 Questioning * Individual/group assignments * projects * Written Tests |
| 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 Tests |

**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/MLF/BC/05/4/B**

**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/MLF/BC/06/4/B**

**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/MLF/BC/07/4/B**

**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

## BASIC TECHNICAL DRAWINGS

**UNIT CODE:** ENG/CU/MLF/CC/01/4/B

**Relationship to Occupational Standard**

This unit addresses the unit of competency: Interpret basic technical drawing

**Duration of Unit:** 100hours

**Unit Description**

This unit covers the competencies required by a mechanical production artisan to interpret basic technical drawings. It involves competencies to: select and use drawing instruments and materials, interpret plain geometry drawings, solid geometry drawings, pictorial and orthographic drawings and mechanical drawings to help in fabrication and machining of components on a lathe machine.

**Summary of Learning Outcomes**

1. Use drawing instruments and materials
2. Interpret plane geometry drawings
3. Interpret solid geometry drawings
4. Interpret orthographic and pictorial drawings
5. Interpret mechanical drawings

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

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Use drawing instruments and materials | * Identification and care of drawing equipment and materials * Reference to manufacturer’s instructions and work place procedures on use and maintenance of drawing equipment and materials * Reference to relevant environmental legislations * Use of Personal Protective Equipment (PPEs) | * Written test * Observation * Oral questioning * Written tests |
| 1. Interpret plane geometry drawings | * Types of lines in drawings * Construction of geometric forms e.g. squares, circles, polygons * Construction of different angles * Measurement of different angles * Bisection of different angles and lines * Standard drawing conventions * Free hand sketching of geometric forms | * Written test * Observation * Oral questioning * Written tests |
| 1. Interpret solid geometry drawings | * Interpretation of sketches and drawings of patterns e.g. prisms, cones. pies, frustrum and pyramids * Sectioning of solids e.g. prisms, cones * Development and interpenetrations of solids e.g. cylinder to cylinder and cylinder to triangular, prism | * Written test * Observation * Oral questioning * Written tests |
| 1. Interpret orthographic and pictorial drawings | * Meaning of orthographic drawings * Meaning of sectioning * Meaning of symbols and abbreviations * Drawing and interpretation of orthographic elevations * Dimensioning of orthographic elevations * Sectioning of views * Meaning of pictorial drawings * Drawing objects in isometric view * Drawing objects in oblique view | * Written test * Observation * Oral questioning * Written tests |
| 1. Interpret mechanical drawings | * Mechanical symbols and abbreviations * Meaning of mechanical drawings * Drawing of mechanical diagrams   + Block   + Line   + Schematic   + Importance of CAD | * Written test * Observation * Oral questioning |

**Suggested Methods of Instruction**

* Projects
* Demonstration by trainer
* Practice by the trainee
* Discussions

**Recommended Resources**

* Drawing room
* Drawing instruments e.g. T-squares, set squares, drawing sets
* Drawing tables
* Pencils, papers, erasers
* Masking tapes
* Teaching models
* Calculators

## METALLIC AND NON-METALLIC MATERIALS

**UNIT CODE:** ENG/CU/MLF/CC/02/4/B

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Use common metallic and non-metallic materials

**Duration of Unit:** 60 hours

**Unit Description:**

This unit covers the unit of competency required by a mechanical production artisan to use common metallic and non-metallic materials. It involves competencies required to: identify properties of engineering materials, ore extraction processes, methods of producing engineering materials, perform heat treatment and prevent material corrosion.

**Summary of Learning Outcomes**

1. Identify properties of engineering materials
2. Identify ore extraction processes of metallic materials
3. Identify methods of producing materials
4. Perform heat treatment
5. Prevent material corrosion

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| * 1. Identify properties of engineering materials | * + Engineering materials are identified as per the applications   + Physical properties of engineering material   + Mechanical properties of engineering materials * Crystal structure of materials | * Written tests * Oral questioning * Assignments * Supervised exercises |
| * 1. Identify ore extraction processes of metallic materials | * Safety measures in metal extraction * Method of metal extraction * Procedure in metal extraction processes * Extraction by-products   + Storing of metal Extraction by- products   + Disposing extraction by- products | * Written tests * Oral questioning * Assignments * Supervised exercises |
| * 1. Identify methods of producing engineering materials | * Types of materials e.g. * Iron * Non-ferrous * Alloys * Ceramics * Composite * Methods of material production and testing * Forms of supply of engineering materials * Finishing and Refinement processes of various types of materials   + - Lapping     - Fine grinding     - Polishing | * Assignments * Oral questioning * Supervised exercises * Written tests |
| 1. Perform heat treatment | * + Safety practices procedures   + Tools and equipment used   + Heat treatment processes * Annealing * Tempering * Normalizing * Hardening * Case hardening   + Procedure in heat treatment processes   + Operations of heat treatment of metals | * Assignments * Supervised exercises * Written tests * Practical test |
| 1. Corrosion and its prevention | * Safety observation during corrosion prevention * Agents of corrosion * Causes of corrosion * Methods of corrosion prevention Corrosion prevention * Painting * Electroplating * Galvanizing * Cathodic * Chromizing | * Assignments * Supervised exercises * Written tests * Practical test |

**Suggested Methods of Instruction**

* Demonstration by trainer
* Discussions
* Practical work by trainee(s)
* Exercises
* Industrial visits
* YouTube for teaching/learning and inspiration
* Simulation
* Power point presentation

**List of Recommended Resources**

**Recommended Resources**

Tools and equipment

* Heat treatment equipment (furnaces, oxy-fuel gas system etc)
* Material testing equipment
* Measuring tools and gauges
* Marking out tools
* Inspection tools and equipment
* Dressing tools
* Firefighting equipment

**Materials and supplies**

* PPEs –dust coat, dust masks, ear muffs, goggles
* First Aid kit
* Brooms and cleaning stuff
* Cleaning detergents
* Drawing papers

## BENCH WORK OPERATIONS

**UNIT CODE:** ENG/CU/MLF/CC/03/4/B

**Relationship to Occupational Standards**:

This unit addresses the unit of competency: Perform bench work operations

Duration of Unit: 100 Hours

**Unit description**

The Mechanical production artisan will be able to perform bench work operations 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 plan work operations, mark out work pieces, set up work pieces on holding devices, assemble metal parts and their sub-assemblies, inspect finished work, perform maintenance and perform housekeeping.

**Summary of Learning Outcome**

1. Observe safety rules and regulations
2. Plan work operations
3. Mark out dimensions on work pieces
4. Set up work pieces on holding devices
5. Use hand tools
6. Use bench drill
7. Assemble metal parts and sub-assemblies
8. Inspect finished work
9. Perform maintenance
10. Perform housekeeping

**Learning Outcomes, Content and suggested assessment methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Observe safety rules and regulations | * Occupational safety health and regulations (OSHA) * Personal protective equipment * Machine safety * Environmental safety | * Administration of written and oral tests * Assessment of worksheet/ operation plans |
| 1. Plan work operations | * Work operation plan procedure * Time management * Work scheduling. * Selection of tools as per the specific operation * Selection of material for the given component | * Observation * Administration of oral and written questions |
| 1. Mark out dimensions on work pieces | * Measuring tools   + Inspection   + calibration * Marking tools * use of marking out tools * Laying out work piece(s) * Transfer of dimensions onto the work piece(s) | * Observation of laying out of work piece(s) * Assessment of transferred dimensions * Administration of oral and written questions |
| 1. Set up work pieces on holding devices | * Work holding devices   + Bench vice   + V-Block   + Angle plate   + G-clamp   + Jigs and fixtures   + Hand vice * Set up work piece on work holding device securely. | * Observation * Written assessment * Oral questioning |
| 1. Use hand tools | * Hand tools   + Files   + Saws   + Hammers   + Chisels   + Taps and dies * Quality specifications   + Dimensions   + Tolerances   + Geometry   + Surface finish   + Functionality | * Observation * Written assessment * Oral assessment * Practical projects |
| 1. Use bench drill | * Marking hole centre * Types of drill bits * Drill machine work holding devices * Drilling operations   + Counter sinking   + Counter boring   + Reaming   + Boring | * Observation * Written assessment * Oral questioning * Practical projects |
| 1. Assemble metal parts and sub-assemblies | * Parts joining methods   + Riveting   + Use of mechanical fasteners   + Use of adhesives   + Soldering   + Brazing   + Welding (gas/arc) * Inspection techniques | * Observation * Written assessment * Oral questioning * Practical project |
| 1. Inspect finished work | * Inspection tools * Inspection methods | * Observation * Written assessment * Oral questioning |
| 1. Perform maintenance | * Servicing and maintenance of machine (lubrication, inspection, alignment and adjustment) * Machine maintenance activities * Preventive maintenance * Maintenance of hand and machine tools and equipment e.g. * Cleaning * Oiling * Painting * Basic inspection * Storage | * Written assessment * Oral questioning * Observation |
| 1. Perform house keeping | * Cleaning of work environment (waste sorting and disposal) * Cleaning and storing of tools and equipment | * Written assessment * Oral questioning * Observation |

**Suggested Methods of Instruction**

* Demonstration by trainer
* Discussions
* Projects
* Practical work by trainee(s)
* Exercises
* Industrials visits
* Internet.
* Simulation

**List of Recommended Resources**

**Tools and equipment suggested but not limited to:**

* Welding
* Drilling machines
* Vices
* Cutting tools
* Combination square
* Centre punch
* Centre lathe
* scribers
* calipers
* Dies and taps
* Surface plate
* V-blocks
* Dial gauge
* Die stock
* Engineer’s square
* File card
* Assorted Files
* Clamps
* Assorted hand tools
* Hammers
* Measuring tools
* Drill bits
* Assorted inspection tools and equipment
* Inspection and measuring tools, GO and NOT GO gauges
* Jigs and fixture
* Pliers
* Rotary disc abrasive grinder
* Reamers
* Saw
* Screwdrivers
* Spiral lowering
* Tap wrench
* Vacuum cleaners
* V-block
* Workbenches
* Firefighting equipment
* First Aid kit

**Materials and supplies suggested but not limited to:**

* Personal safety gear:
* Goggles
* Safety shoes
* Overall
* Cap
* Ear Muffs
* Gloves
* Drawing papers
* Raw materials
* Mild steel plate
* Sheet metal
* Brass sheets
* Zinc sheets
* Aluminum sheets
* Bright Drawn Mild Steel
* Carbon steel
* Brass rods
* Aluminum rods
* Abrasive materials
* Grinding paste
* Cotton wastes
* Cleaning detergents
* Vacuum cleaners
* Mops/ Brooms and buckets

# CORE UNITS OF LEARNING

## SHEET METAL FABRICATION

**UNIT CODE:** ENG/CU/MLF/CR/01/4/B

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Fabricate sheet metal parts

**Duration of Unit:** 150 hours

**Unit Description**

This unit covers the competencies required by a Mechanical production (Lathe and Fabrication) artisan to fabricate sheet metal parts. It includes competencies that ensure the learner will: observe safety rules and regulations, identify sheet metal tools & Equipment, read and interpret working drawing, mark out, set up sheet metal fabrication machines and equipment, fabricate sheet metal components, assess quality of components, maintain sheet metal fabrication tools, machine and equipment and perform housekeeping

**Summary of Learning Outcomes**

1. Observe safety rules and regulations
2. Use sheet metal machines, tools & equipment.
3. Plan work operation
4. Mark out work pieces
5. Set- up sheet metal machine and equipment
6. Fabricate sheet metal component (s)
7. Assess Quality of the fabricated component(s)
8. Maintain sheet metal machines, tools and equipment
9. Perform housekeeping

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Observe safety rules and regulations | * Prescription of personal safety, PPEs worn in accordance to the work environment * Safety regulations on OSHs and factory Act * Observation of safe working environment * Adherence to workplace procedures environment measurements of OSH | * Oral questions * Written tests * Observation |
| 1. Use sheet metal machines, tools & equipment. | * Types of sheet metal machine tools / equipment * Parts of sheet metal machine tools/ equipment and their functions * Sheet metal machine tools / equipment selection and usage. | * Oral questions * Written tests * Practical test * Observation |
| 1. Plan work operation | * Work operation plan procedure * Interpretation of drawing * Time management * Work scheduling. * Selection of tools as per the specific operation * Selection of material for the given component | * Oral questions * Written tests * Practical test * Observation |
| 1. Mark out work pieces | * Selection of measuring and marking out tools * Dimensional specifications * Marking out | * Oral questions * Written tests * Practical test * Observation |
| 1. Set- up sheet metal machine | * Machine tool selection * Mounting of machine tool/equipment attachment | * Oral questions * Written tests * Practical test * Observation |
| 1. Fabricate sheet metal component (s) | * Production of sheet metal work pieces * Sheet metal joining methods * Sheet metal joining techniques * Sheet metal joining fasteners | * Oral questions * Written tests * Practical test * Observation |
| 1. Assess Quality of the fabricated component(s) | * Cleaning of the finished work piece * Inspection of the finished work piece * Assessment of the finished work pieces and their function ability | * Oral questions * Written tests * Practical test * Observation |
| 1. Maintain sheet metal machines, tools and equipment | * Cleaning of the machine tools and equipment after the work * Inspection of machine tools and equipment after the work * Fault identification and reporting * Lubrication of the machine tools/equipment & accessories | * Oral questions * Written tests * Practical test * Observation |
| 1. Perform housekeeping | * Work place cleaning procedures * Waste segregation and disposal * Storage of tools and equipment | * Oral questions * Written tests * Practical test * Observation |

**Suggested Methods of Instruction**

* Instructor led facilitation of theory
* Demonstration by trainer
* Practical work by trainee
* Field trips
* Viewing of related videos

**Recommended Resources**

* 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 boots
* Safety harness
* Arm/Hand guard, gloves
* Eye protection (goggles, shield)
* Hearing protection (ear muffs, ear plugs)
* Hair Net/cap/bonnet
* Head hat
* Face protection (mask, shield)
* Apron/Gown/coverall/jump suit
* Anti-static suits
* High-visibility reflective vest

## LATHE MACHINE OPERATIONS

**UNIT CODE:** ENG/CU/MLF/CR/02/4/B

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Produce components on the lathe

**Duration of Unit:** 150 hours

**Unit Description**

This unit covers the competencies required to produce components on the lathe. Competencies include; identify lathe machine parts accessories and their functions, prepare operation procedure sheet, mount work pieces, perform lathe machine operations, assess quality of finished work, organize work area and maintain machine tool and accessories and observe safety rules and regulations**.**

**Summary of Learning Outcomes**

1. Observe safety rules and regulations
2. Identify machine parts, tools, accessories and their functions
3. Prepare operation plan
4. Mount work piece
5. Perform machining to specifications
6. Assess quality of finished work
7. Maintain machine tool and accessories
8. Perform house keeping

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

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Observe safety rules and regulations | * Personal safety * Wear PPEs * No horse play * Machine, tools and equipment safety * Machine guards * Operational procedures * Proper insulations * Recommended handling * Safe work environment * Avoid spills * Lighting * Aeration * Clear gang ways | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Identify machine parts, tools, accessories and their functions | * Lathe parts * Headstock * Tailstock * Guideways * Bed * Apron * Carriage * Cross and top slide * Chuck * Tools and accessories * Turning tools * Threading tools * Grooving tools * Boring tools and bars * Facing tools * Steadies * Faceplate * Taper turning attachment * Lathe dogs * Collets * Mandrels * Tool materials and nature * Tool bars * Inserts * HSS * Diamond tip * Carbides | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Prepare operation plan | * Sequence of operations * Order of operation * Rough cuts * Finishing cuts * Number of cuts * Cutting data * Depth of cut * Length of cut * Feed rate * Cutting speed * Spindle speed * Cutting angle * Taper angle * Chamfer angle * Production time * Specific time per tasks * Total production time | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Mount work piece | * Work holding and devices * Work length * Three jaws chuck * Four jaws chuck * Collets * Face plate * Tail stock centres * Steadies * Lathe dogs * Tool and work setting * Tool below work centre * Tool above work centre * Tool chatter * Self-centring * Use of the scribing block and dial gauge * Effect of work wobbling | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Perform machining to specifications | * Lathe operations * Facing * Turning * Grooving * Drilling * Boring * Threading * Chamfering * Knurling * Taper turning * Parting off * Cutting parameters * Depth of cut * Feed rate * Cutting speed * Spindle speed * Use of coolant * Types of chips * Continuous chips * Discontinuous chips * Continuous chips with a built up edge | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Assess quality of finished work | * Dimensions * Linear * Diameter * Pitch * Surface roughness * Measurement and inspection tools * Vernier caliper * Micrometer * Depth gauge * GO and NOT GO gauges * Surface analysers * Assembly * Functionality * Tolerances * Limits and fits * Geometry * Squareness * Concentricity * Angularity * Straightness |  |
| 1. Maintain machine tool and accessories | * Cleaning * Removal of chips * Wiping coolant spills * Wiping of tools and accessories * Oiling of surfaces and guide ways * Lubrication of moving parts * Inspection and reporting of faults | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Perform house keeping | * Cleaning * Removal of chips * Floor mopping * Waste sorting * Metallic waste * Rags * Plastics * Waste disposal * Recycling * Burning * Burying * Re-use | * Observation * Oral questioning * Practical tests * Written tests |

**Suggested Methods of Instruction**

* Demonstration by trainer
* Practice by the trainee
* Field trips
* On-job-training
* Discussions

**Recommended Resources**

* Lathe machine
* Lathe tools and accessories
* Measuring and inspection tools
* Coolant
* Work holding devices
* Work piece material
* Resource materials, manuals for cutting tools & lathe
* Work place procedures
* Calculator
* Projectors
* Computers
* Manuals
* Printers
* Internet
* Occupational Safety and Health Act (OSHA)
* National Environmental Management Authority (NEMA) regulations
* Other relevant resources