



THE KISII NATIONAL POLYTECHNIC

P.O. BOX 222-40200,

KISII, KENYA.

COMPETENCY BASED CURRICULUM

FOR

ARTISAN IN MECHANICAL PRODUCTION

LEVEL 4

First published 2021

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Governing Council Secretary/Principal

Kisii National Polytechnic

P.O. Box 222-40200, Kenya

Email: info@kisiipoly.ac.ke

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.

GOVERNING COUNCIL SECRETARY/PRINCIPAL

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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

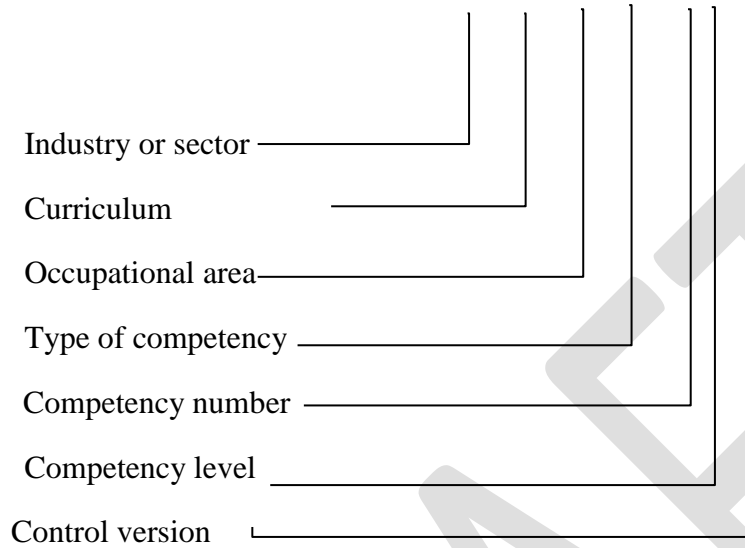


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OVERVIEW

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
MEBC001	Communication skills	20	2
MEBC002	Numeracy skills	25	3
MEBC003	Digital Literacy	35	3.5
MEBC004	Entrepreneurial skills	60	6
MEBC005	Employability skills	30	3
MEBC006	Environmental literacy	20	2
MEBC007	Occupational safety and health practices	20	2
Total		210	21

Common Units of Learning

Unit Code	Unit Title	Duration in Hours	Credit Factors
MECC001	Basic technical drawing	100	10
MECC002	Metallic and non-metallic materials	60	6
MECC003	Bench work operations	80	10
Total		240	26

Core Units of Learning

Unit Code	Unit Title	Duration in Hours	Credit Factors
MECR001	Sheet metal fabrication	100	15

MECR002	Lathe machine operations	150	15
MECR003	Grinding operations	80	
MECR004	Milling operations	100	
MECR005	Industrial Attachment	300	30
Total		600	60
Grand Total		1180	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:

- a) Kenya Certificate of Secondary Education (K.C.S.E.) grade E
- Or**
- b) Level 3 certificate in related course with **one** year of continuous work experience
- Or**
- c) 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	<ul style="list-style-type: none">• 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	<ul style="list-style-type: none">• Interview• Third party reports

2. Complete relevant work-related documents	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Interview • Third party reports
3. Communicate information about workplace processes	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Interview • Portfolio
4. Lead workplace discussion	<ul style="list-style-type: none"> • Methods of discussion e.g. <ul style="list-style-type: none"> ✓ Coordination meetings ✓ Toolbox discussion ✓ Peer-to-peer discussion • Solicitation of response 	<ul style="list-style-type: none"> • Interview • Third party reports

5. Identify and communicate issues arising in the workplace	<ul style="list-style-type: none"> • Identification of problems and issues • Organizing information on problems and issues • Relating problems and issues • Communication barriers affecting workplace discussions 	<ul style="list-style-type: none"> • Interview • Portfolio
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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: 25 hours

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	<ul style="list-style-type: none">• Whole numbers• Simple fractions• Decimals• Percentages• Sizes• Problem solving methods• Calculations using the 4 operations	<ul style="list-style-type: none">• Written Tests• Practice assignments

	<ul style="list-style-type: none"> Recording and communicating numerical information 	
2. Identify, measure and estimate familiar quantities for work	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> Written Tests Practice assignments
3. Read and use familiar maps, plans and diagrams for work	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> Practical test Written Tests
4. Identify and describe common 2D and some 3D shapes for work	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> Written Tests Practical test

	<p>shapes and some common three-dimensional shapes</p> <ul style="list-style-type: none"> • Construction of common 2D shapes • Match common 3D shapes to their 2D sketches or nets 	
5. Construct simple tables and graphs for work using familiar data	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Written Tests • Practical test
6. Identify and interpret information in familiar tables, graphs and charts for work	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Written Tests • Practical test

	<ul style="list-style-type: none"> • 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 	
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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	<ul style="list-style-type: none">• Meaning of a computer• Functions of a computer• Components of a computer• Classification of computers	<ul style="list-style-type: none">• Written tests• Oral Questioning• Observation
2. Apply security measures to data, hardware and software	<ul style="list-style-type: none">• Data security and control• Security threats and control measures• Types of computer crimes• Detection and protection against computer crimes	<ul style="list-style-type: none">• Written tests• Oral presentation• Observation• Projects
3. Apply computer software in solving tasks	<ul style="list-style-type: none">• Operating system• Word processing• Spread sheets• Data base	<ul style="list-style-type: none">• Oral questioning• Observation• Project

4. Apply internet and email in communication at workplace	<ul style="list-style-type: none"> • Computer networks • Uses of internet • Electronic mail (e-mail) concept 	<ul style="list-style-type: none"> • Oral questioning • Observation • Oral presentation • Written report
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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	<ul style="list-style-type: none">• 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	<ul style="list-style-type: none">• Individual/group assignments• projects• Written Tests• Oral Questioning

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	<ul style="list-style-type: none"> • 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 	
2. Establish small scale business customer base	<ul style="list-style-type: none"> • Good staff/workers and customer relations • Marketing strategy • Identifying and maintain new customers and markets • Product/ service promotions • Products / services diversification • SWOT / PESTEL analysis 	<ul style="list-style-type: none"> • Individual/group assignments • projects • Written Tests • Oral Questioning

	<ul style="list-style-type: none"> • Conducting a business survey • Generating Business ideas • Business opportunities 	
3. Manage small scale business	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Oral Questioning • Individual/group assignments • projects • Written Tests
4. Grow/expand small scale business	<ul style="list-style-type: none"> • Methods of growing small business • Resources for growing small business 	<ul style="list-style-type: none"> • Individual/group assignments • projects • Written Tests

	<ul style="list-style-type: none"> • Small business growth plan • Computer software in business development • ICT and business growth 	
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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	<ul style="list-style-type: none">• 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	<ul style="list-style-type: none">• Written tests• Oral questioning• Portfolio of evidence• Third party report

	<ul style="list-style-type: none"> • Self-awareness • Self-development • Financial literacy • Healthy lifestyle practices 	
2. Demonstrate critical safe work habits	<ul style="list-style-type: none"> • Stress and stress management • Punctuality and time consciousness • Interpersonal communication • Sharing information • Leisure • Integrating personal objectives into organizational objectives • Resources utilization • Setting work priorities • HIV and AIDS • Drug and substance abuse • Handling emerging issues 	<ul style="list-style-type: none"> • Written tests • Oral questioning • Portfolio of evidence • Third party report
3. Demonstrate workplace learning	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Written tests • Oral questioning • Portfolio of evidence • Third party report
4. Demonstrate workplace ethics	<ul style="list-style-type: none"> • Meaning of ethics • Ethical perspectives • Principles of ethics • Values and beliefs • Ethical standards • Organization code of ethics 	<ul style="list-style-type: none"> • Written tests • Oral questioning • Portfolio of evidence • Third party report

	<ul style="list-style-type: none"> • 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 	
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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: 20 hours

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	<ul style="list-style-type: none">• 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)	<ul style="list-style-type: none">• Written tests• Oral questions• Observation of work procedures
2. Control environmental Pollution	<ul style="list-style-type: none">• Types of pollution	<ul style="list-style-type: none">• Written tests

	<ul style="list-style-type: none"> • Environmental pollution control measures • Types of solid wastes • Procedures for solid waste management • Different types of noise pollution • Methods for minimizing noise pollution 	<ul style="list-style-type: none"> • Oral questions • Observation of work procedures • Role play
3. Demonstrate sustainable resource use	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Written tests • Oral questions • Observation of work procedures
4. Evaluate current practices in relation to resource usage	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Written tests • Oral questions • Observation of work procedures
5. Identify Environmental legislations/conventions for environmental concerns	<ul style="list-style-type: none"> • Environmental issues/concerns • Environmental legislations /conventions and local ordinances 	<ul style="list-style-type: none"> • Written tests • Oral questions

	<ul style="list-style-type: none"> • Industrial standard /environmental practices • International Environmental Protocols (Montreal, Kyoto) • Features of an environmental strategy 	<ul style="list-style-type: none"> • Observation of work procedures
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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	<ul style="list-style-type: none">• 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.	<ul style="list-style-type: none">• Oral questions• Written tests• Portfolio of evidence• Third party report
2. Participate in arrangements for workplace safety and health maintenance	<ul style="list-style-type: none">• Participating in orientations on OSH requirements/regulations of tasks• Providing feedback on health, safety, and security concerns to	<ul style="list-style-type: none">• Oral questions• Written tests• Portfolio of evidence

	<p>appropriate personnel as required in a sufficiently detailed manner</p> <ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Third party report
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Suggested Methods of Instruction

- Assignments
- 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

DRAFT

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: 100 hours

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	<ul style="list-style-type: none">• 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<ul style="list-style-type: none">▪ Use of Personal Protective Equipment (PPEs)	<ul style="list-style-type: none">• Written test• Observation• Oral questioning• Written tests

Learning Outcome	Content	Suggested Assessment Methods
2. Interpret plane geometry drawings	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Written test • Observation • Oral questioning • Written tests
3. Interpret solid geometry drawings	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Written test • Observation • Oral questioning • Written tests
4. Interpret orthographic and pictorial drawings	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Written test • Observation • Oral questioning • Written tests

Learning Outcome	Content	Suggested Assessment Methods
5. Interpret mechanical drawings	<ul style="list-style-type: none"> • Mechanical symbols and abbreviations • Meaning of mechanical drawings • Drawing of mechanical diagrams <ul style="list-style-type: none"> • Block • Line • Schematic • Importance of CAD 	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none">• Engineering materials are identified as per the applications• Physical properties of engineering material• Mechanical properties of engineering materials• Crystal structure of materials	<ul style="list-style-type: none">• Written tests• Oral questioning• Assignments• Supervised exercises
2. Identify ore extraction processes of metallic materials	<ul style="list-style-type: none">• Safety measures in metal extraction• Method of metal extraction• Procedure in metal extraction processes• Extraction by-products	<ul style="list-style-type: none">• Written tests• Oral questioning• Assignments• Supervised exercises

	<ul style="list-style-type: none"> • Storing of metal Extraction by-products • Disposing extraction by-products 	
3. Identify methods of producing engineering materials	<ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> ▪ Lapping ▪ Fine grinding ▪ Polishing 	<ul style="list-style-type: none"> • Assignments • Oral questioning • Supervised exercises • Written tests
4. Perform heat treatment	<ul style="list-style-type: none"> • Safety practices procedures • Tools and equipment used • Heat treatment processes <ul style="list-style-type: none"> • Annealing • Tempering • Normalizing • Hardening • Case hardening • Procedure in heat treatment processes • Operations of heat treatment of metals 	<ul style="list-style-type: none"> • Assignments • Supervised exercises • Written tests • Practical test
5. Corrosion and its prevention	<ul style="list-style-type: none"> • Safety observation during corrosion prevention • Agents of corrosion • Causes of corrosion 	<ul style="list-style-type: none"> • Assignments • Supervised exercises • Written tests • Practical test

	<ul style="list-style-type: none"> • Methods of corrosion prevention <p>Corrosion prevention</p> <ul style="list-style-type: none"> • Painting • Electroplating • Galvanizing • Cathodic • Chromizing 	
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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	<ul style="list-style-type: none">• Occupational safety health and regulations (OSHA)• Personal protective equipment• Machine safety• Environmental safety	<ul style="list-style-type: none">• Administration of written and oral tests• Assessment of worksheet/ operation plans
2. Plan work operations	<ul style="list-style-type: none">• Work operation plan procedure• Time management• Work scheduling.	<ul style="list-style-type: none">• Observation

Learning Outcome	Content	Suggested Assessment Methods
	<ul style="list-style-type: none"> • Selection of tools as per the specific operation • Selection of material for the given component 	<ul style="list-style-type: none"> • Administration of oral and written questions
3. Mark out dimensions on work pieces	<ul style="list-style-type: none"> • Measuring tools <ul style="list-style-type: none"> • Inspection • calibration • Marking tools • use of marking out tools • Laying out work piece(s) • Transfer of dimensions onto the work piece(s) 	<ul style="list-style-type: none"> • Observation of laying out of work piece(s) • Assessment of transferred dimensions • Administration of oral and written questions
4. Set up work pieces on holding devices	<ul style="list-style-type: none"> • Work holding devices <ul style="list-style-type: none"> • Bench vice • V-Block • Angle plate • G-clamp • Jigs and fixtures • Hand vice • Set up work piece on work holding device securely. 	<ul style="list-style-type: none"> • Observation • Written assessment • Oral questioning
5. Use hand tools	<ul style="list-style-type: none"> • Hand tools <ul style="list-style-type: none"> • Files • Saws • Hammers • Chisels • Taps and dies • Quality specifications <ul style="list-style-type: none"> • Dimensions • Tolerances • Geometry • Surface finish • Functionality 	<ul style="list-style-type: none"> • Observation • Written assessment • Oral assessment • Practical projects
6. Use bench drill	<ul style="list-style-type: none"> • Marking hole centre • Types of drill bits 	<ul style="list-style-type: none"> • Observation • Written assessment • Oral questioning

Learning Outcome	Content	Suggested Assessment Methods
	<ul style="list-style-type: none"> • Drill machine work holding devices • Drilling operations <ul style="list-style-type: none"> • Counter sinking • Counter boring • Reaming • Boring 	<ul style="list-style-type: none"> • Practical projects
7. Assemble metal parts and sub-assemblies	<ul style="list-style-type: none"> • Parts joining methods <ul style="list-style-type: none"> • Riveting • Use of mechanical fasteners • Use of adhesives • Soldering • Brazing • Welding (gas/arc) • Inspection techniques 	<ul style="list-style-type: none"> • Observation • Written assessment • Oral questioning • Practical project
8. Inspect finished work	<ul style="list-style-type: none"> • Inspection tools • Inspection methods 	<ul style="list-style-type: none"> • Observation • Written assessment • Oral questioning
9. Perform maintenance	<ul style="list-style-type: none"> • Servicing and maintenance of machine (lubrication, inspection, alignment and adjustment) • Machine maintenance activities <ul style="list-style-type: none"> • Preventive maintenance • Maintenance of hand and machine tools and equipment e.g. <ul style="list-style-type: none"> • Cleaning • Oiling • Painting • Basic inspection • Storage 	<ul style="list-style-type: none"> • Written assessment • Oral questioning • Observation
10. Perform house keeping	<ul style="list-style-type: none"> • Cleaning of work environment (waste sorting and disposal) 	<ul style="list-style-type: none"> • Written assessment • Oral questioning • Observation

Learning Outcome	Content	Suggested Assessment Methods
	<ul style="list-style-type: none"> Cleaning and storing of tools and equipment 	<ul style="list-style-type: none">

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
- scribes
- 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	<ul style="list-style-type: none">• Prescription of personal safety, PPEs worn in accordance to the work environment	<ul style="list-style-type: none">• Oral questions• Written tests• Observation

	<ul style="list-style-type: none"> • Safety regulations on OSHs and factory Act • Observation of safe working environment • Adherence to workplace procedures environment measurements of OSH 	
2. Use sheet metal machines, tools & equipment.	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • Oral questions • Written tests • Practical test • Observation
3. Plan work operation	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Oral questions • Written tests • Practical test • Observation
4. Mark out work pieces	<ul style="list-style-type: none"> • Selection of measuring and marking out tools • Dimensional specifications • Marking out • 	<ul style="list-style-type: none"> • Oral questions • Written tests • Practical test • Observation
5. Set- up sheet metal machine	<ul style="list-style-type: none"> • Machine tool selection • Mounting of machine tool/equipment attachment 	<ul style="list-style-type: none"> • Oral questions • Written tests • Practical test • Observation
6. Fabricate sheet metal component (s)	<ul style="list-style-type: none"> • Production of sheet metal work pieces • Sheet metal joining methods • Sheet metal joining techniques • Sheet metal joining fasteners 	<ul style="list-style-type: none"> • Oral questions • Written tests • Practical test • Observation

7. Assess Quality of the fabricated component(s)	<ul style="list-style-type: none"> • Cleaning of the finished work piece • Inspection of the finished work piece • Assessment of the finished work pieces and their function ability 	<ul style="list-style-type: none"> • Oral questions • Written tests • Practical test • Observation
8. Maintain sheet metal machines, tools and equipment	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Oral questions • Written tests • Practical test • Observation
9. Perform housekeeping	<ul style="list-style-type: none"> • Work place cleaning procedures • Waste segregation and disposal • Storage of tools and equipment 	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none">• Personal safety<ul style="list-style-type: none">• Wear PPEs• No horse play• Machine, tools and equipment safety<ul style="list-style-type: none">• Machine guards• Operational procedures• Proper insulations• Recommended handling	<ul style="list-style-type: none">• Observation• Oral questioning• Practical tests• Written tests

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Learning Outcome	Content	Suggested Assessment Methods
	<ul style="list-style-type: none"> • Safe work environment <ul style="list-style-type: none"> • Avoid spills • Lighting • Aeration • Clear gang ways 	
<p>2. Identify machine parts, tools, accessories and their functions</p>	<ul style="list-style-type: none"> • Lathe parts <ul style="list-style-type: none"> • Headstock • Tailstock • Guideways • Bed • Apron • Carriage • Cross and top slide • Chuck • Tools and accessories <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • Tool bars • Inserts • HSS 	<ul style="list-style-type: none"> • Observation • Oral questioning • Practical tests • Written tests

Learning Outcome	Content	Suggested Assessment Methods
	<ul style="list-style-type: none"> • Diamond tip • Carbides • 	
3. Prepare operation plan	<ul style="list-style-type: none"> • Sequence of operations <ul style="list-style-type: none"> • Order of operation • Rough cuts • Finishing cuts • Number of cuts • Cutting data <ul style="list-style-type: none"> • Depth of cut • Length of cut • Feed rate • Cutting speed • Spindle speed • Cutting angle <ul style="list-style-type: none"> • Taper angle • Chamfer angle • Production time <ul style="list-style-type: none"> • Specific time per tasks • Total production time • 	<ul style="list-style-type: none"> • Observation • Oral questioning • Practical tests • Written tests
4. Mount work piece	<ul style="list-style-type: none"> • Work holding and devices <ul style="list-style-type: none"> • Work length • Three jaws chuck • Four jaws chuck • Collets • Face plate • Tail stock centres • Steadies • Lathe dogs • Tool and work setting <ul style="list-style-type: none"> • Tool below work centre • Tool above work centre 	<ul style="list-style-type: none"> • Observation • Oral questioning • Practical tests • Written tests

Learning Outcome	Content	Suggested Assessment Methods
	<ul style="list-style-type: none"> • Tool chatter • Self-centring • Use of the scribing block and dial gauge • Effect of work wobbling 	
5. Perform machining to specifications	<ul style="list-style-type: none"> • Lathe operations <ul style="list-style-type: none"> • Facing • Turning • Grooving • Drilling • Boring • Threading • Chamfering • Knurling • Taper turning • Parting off • Cutting parameters <ul style="list-style-type: none"> • Depth of cut • Feed rate • Cutting speed • Spindle speed • Use of coolant • Types of chips <ul style="list-style-type: none"> • Continuous chips • Discontinuous chips • Continuous chips with a built up edge • 	<ul style="list-style-type: none"> • Observation • Oral questioning • Practical tests • Written tests
6. Assess quality of finished work	<ul style="list-style-type: none"> • Dimensions <ul style="list-style-type: none"> • Linear • Diameter • Pitch 	

Learning Outcome	Content	Suggested Assessment Methods
	<ul style="list-style-type: none"> • Surface roughness • Measurement and inspection tools <ul style="list-style-type: none"> • Vernier caliper • Micrometer • Depth gauge • GO and NOT GO gauges • Surface analysers • Assembly <ul style="list-style-type: none"> • Functionality • Tolerances • Limits and fits • Geometry <ul style="list-style-type: none"> • Squareness • Concentricity • Angularity • Straightness 	
7. Maintain machine tool and accessories	<ul style="list-style-type: none"> • Cleaning <ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Observation • Oral questioning • Practical tests • Written tests
8. Perform house keeping	<ul style="list-style-type: none"> • Cleaning <ul style="list-style-type: none"> • Removal of chips • Floor mopping • Waste sorting <ul style="list-style-type: none"> • Metallic waste • Rags • Plastics • Waste disposal <ul style="list-style-type: none"> • Recycling 	<ul style="list-style-type: none"> • Observation • Oral questioning • Practical tests • Written tests

Learning Outcome	Content	Suggested Assessment Methods
	<ul style="list-style-type: none"> • Burning • Burying • Re-use 	

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

GRINDING OPERATIONS

UNIT CODE: ENG/CU/ME/CR/02/5/A

Relationship to Occupational Standards

This unit addresses the unit of competency: Perform grinding operations

Duration of Unit: 150 hours

Unit Description

This unit covers the competencies required by a mechanical production technician to perform grinding operations. In the context of the standard the technician is to: observe safety rules and regulations, identify grinding machine parts and accessories, prepare work operation plan, set up grinding machine, perform grinding operations, assess quality of finished work, maintain grinding machine and perform housekeeping.

Summary of Learning Outcomes

1. Observe safety rules and regulations
2. Identify machine parts, accessories and their functions.
3. Identify types and features of grinding wheels
4. Prepare work operation plan
5. Set- up the grinding machine
6. Perform grinding operations

7. Assess quality of finished work
8. Maintain the grinding machine, tool and accessories
9. Perform Housekeeping
10. Document report

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Observe safety rules and regulations	<input type="checkbox"/> Personal safety, PPEs in accordance to the work environment <input type="checkbox"/> Grinding machine tools safety precautions <input type="checkbox"/> Safety regulations on OSHA <input type="checkbox"/> Workplace procedures and environment measures	<ul style="list-style-type: none"> • Oral questions • Written tests • Observation
2. Identify machine parts, accessories and their functions	<input type="checkbox"/> Types of grinding machine tools / equipment <ul style="list-style-type: none"> • Surface grinding machine • Portable grinding machine • Cylindrical grinding machine <input type="checkbox"/> Parts of grinding machine tools/ equipment and their functions <input type="checkbox"/> Grinding machine tools / equipment selection and applications.	<ul style="list-style-type: none"> • Oral questions • Written tests • Practical test • Observation of implementation of control measures
3. Identify types and features of grinding wheels	<input type="checkbox"/> Types of grinding wheels/stones <input type="checkbox"/> Grinding wheels/ stones defects <ul style="list-style-type: none"> ○ Glazing ○ Gumming <input type="checkbox"/> Wheel dressing <input type="checkbox"/> Grinding wheels calculation and geometry <input type="checkbox"/> Grinding wheel balancing <input type="checkbox"/> Abrasive materials principles <input type="checkbox"/> Abrasive materials identification	<ul style="list-style-type: none"> • Oral questions • Written tests • Practical test • Observation
4. Prepare work operation plan	<input type="checkbox"/> Work plan procedure <input type="checkbox"/> Time management <input type="checkbox"/> Work scheduling. <input type="checkbox"/> Selection of tools <input type="checkbox"/> Selection of materials	<ul style="list-style-type: none"> • Oral questions • Written tests • Practical test • Observation

	<input type="checkbox"/> Dimensions <input type="checkbox"/> Tolerances <input type="checkbox"/> Drawing standards <input type="checkbox"/> Geometric symbols and abbreviations <input type="checkbox"/> Operation plan development	
5. Set- up the grinding machine	<input type="checkbox"/> Principle of operation <input type="checkbox"/> Grinding operation <input type="checkbox"/> Wheel/stones selection and mounting <input type="checkbox"/> Work piece securing/mounting	<ul style="list-style-type: none"> • Oral questions • Written tests • Practical test • Observation
6. Perform grinding operations	<input type="checkbox"/> Grinding operations <input type="checkbox"/> Surface grinding <input type="checkbox"/> Portable grinding machine operation <input type="checkbox"/> Cylindrical grinding operation: <ul style="list-style-type: none"> ○ External cylindrical grinding operation ○ Internal cylindrical grinding operation <input type="checkbox"/> Centre-less grinding operation <input type="checkbox"/> Form grinding operation <input type="checkbox"/> Wet and dry grinding operations	<ul style="list-style-type: none"> • Oral questions • Written tests • Practical test • Observation
7. Assess quality of finished work	<input type="checkbox"/> Dimensional accuracy analysis <input type="checkbox"/> Surface finish checks <input type="checkbox"/> Functionality checks <input type="checkbox"/> Inspection of the finished work piece	<ul style="list-style-type: none"> • Oral questions • Written tests • Practical test • Observation
8. Maintain the grinding machine	<input type="checkbox"/> Cleaning of the machine tools and equipment <input type="checkbox"/> Inspection of machine tools and equipment <input type="checkbox"/> Fault identification and reporting <input type="checkbox"/> Servicing of the machine tools, equipment & accessories	<ul style="list-style-type: none"> • Oral questions • Written tests • Practical test • Observation
9. Perform housekeeping	<input type="checkbox"/> Work place cleaning procedures <input type="checkbox"/> Waste segregation and disposal <input type="checkbox"/> Storage of tools and equipment	<ul style="list-style-type: none"> • Oral questions • Written tests • Practical test • Observation
10. Document Report	<input type="checkbox"/> Defects/ deviations report <input type="checkbox"/> Cost variations report <input type="checkbox"/> Accidents and incidents report xxx	<input type="checkbox"/> Oral questions <input type="checkbox"/> Written tests <input type="checkbox"/> Practical test <input type="checkbox"/> Observation

Suggested Delivery Methods

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- Instructor led facilitation of theory
- Demonstration by trainer
- Practical work by trainee
- 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
 - ✓ Hard hat
 - ✓ Face protection (mask, shield)
 - ✓ Apron/Gown/coverall/jump suit
 - ✓ Anti-static suits
 - ✓ High-visibility reflective vest

MILLING MACHINE OPERATIONS

UNIT CODE: MECR004

Relationship to Occupational Standards

This unit addresses the unit of competency: Produce components on a milling machine tool

Duration of Unit: 200 hours

Unit Description

The Mechanical production technician will be able to produce components on a milling machine tool while observing occupational safety and health legislations, regulations and safe working practices. In the context of the standards, the learner is to; identify parts of a milling machine, plan work operations, mark out workpieces, set up machine tool and perform machining, assess the quality of the machined parts as well as perform maintenance of the machine tools and housekeeping on the work area.

Summary of Learning Outcomes

1. Observe safety rules and regulations
2. Identify parts of a milling machine tool
3. Plan work operations
4. Mark out work piece
5. Set up milling machine tool for a specific operation
6. Perform machining as per the specifications
7. Assess quality of machined parts
8. Maintain machine tool and accessories
9. Perform housekeeping
10. Document report

Learning Outcomes, Content and Suggested Assessment Methods:

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Learning Outcome	Content	Suggested Assessment Methods
1. Observe safety rules and regulations	<input type="checkbox"/> Occupational safety and health regulations (OSHA) <input type="checkbox"/> Personal protective equipment <input type="checkbox"/> Machinery safety <input type="checkbox"/> Environmental safety <input type="checkbox"/> Occupational Hygiene <input type="checkbox"/> First aid <input type="checkbox"/> Fire fighting	<ul style="list-style-type: none"> • Observation • Oral questioning • Written tests
2. Identify parts of a milling machine tool	<input type="checkbox"/> Types of milling machines <ul style="list-style-type: none"> ○ Vertical ○ Horizontal ○ Universal <input type="checkbox"/> Parts of milling machine tool <ul style="list-style-type: none"> ○ Functions <input type="checkbox"/> Milling machine accessories	<ul style="list-style-type: none"> • Observation • Oral questioning • Written tests
3. Plan work operations	<input type="checkbox"/> Work plan procedure <input type="checkbox"/> Time management <input type="checkbox"/> Work scheduling. <input type="checkbox"/> Selection of tools <input type="checkbox"/> Selection of materials <input type="checkbox"/> Dimensions <input type="checkbox"/> Tolerances <input type="checkbox"/> Drawing standards <input type="checkbox"/> Geometric symbols and abbreviations <input type="checkbox"/> Operation plan development	<ul style="list-style-type: none"> • Observation • Oral questioning • Written tests • Practical exercise • Projects
4. Mark out work piece	<input type="checkbox"/> Measuring tools <ul style="list-style-type: none"> ○ Types ○ Inspection ○ calibration <input type="checkbox"/> Marking-out tools <input type="checkbox"/> Laying out work piece(s) <input type="checkbox"/> Transfer of dimensions onto the work piece(s)	<ul style="list-style-type: none"> • Observation • Oral questioning • Practical exercise • Written tests • Projects
5. Set up milling machine tool for a specific operation	<input type="checkbox"/> Work holding devices and their applications <ul style="list-style-type: none"> ○ Machine vice ○ Machine spindle (arbor ○ V-Block 	<ul style="list-style-type: none"> • Observation • Oral questioning • Practical exercise • Written tests

	<ul style="list-style-type: none"> ○ Angle plate ○ Machine table ○ Jigs and fixtures ○ Indexing head <input type="checkbox"/> Workpiece set-up <input type="checkbox"/> Milling cutters <ul style="list-style-type: none"> ○ Side and Face cutter ○ End mill ○ Slot cutter ○ Gear cutter ○ Boring tool ○ Fly cutter <input type="checkbox"/> Speeds and feed rates <ul style="list-style-type: none"> ○ Spindle speed ○ Cross feed ○ Transverse feed ○ Vertical feed 	
6. Perform machining as per the specifications	<input type="checkbox"/> Milling operations <ul style="list-style-type: none"> ○ Slot cutting ○ Gear cutting ○ Boring ○ Face milling ○ Slab milling ○ Indexing <input type="checkbox"/> Cutting fluids <ul style="list-style-type: none"> ○ Types ○ Properties ○ Functions <input type="checkbox"/> Milling specification <ul style="list-style-type: none"> ○ Dimensions and tolerances ○ Geometry (Concentricity, Straightness, Flatness, Squareness and roundness) ○ Surface finish 	<ul style="list-style-type: none"> • Observation • Oral questioning • Practical exercise • Written tests • Projects
7. Assess quality of machined parts	<input type="checkbox"/> Inspection tools <input type="checkbox"/> Inspection methods <input type="checkbox"/> Inspection specifications <ul style="list-style-type: none"> ○ Dimensions and tolerances ○ Geometry (Concentricity, Straightness, Flatness, 	<ul style="list-style-type: none"> • Observation • Oral questioning • Practical exercise • Written tests

	Squareness and roundness) <ul style="list-style-type: none"> ○ Surface finish ○ Functionality 	
8. Maintain machine tool and accessories	<input type="checkbox"/> Maintenance of machine and accessories <ul style="list-style-type: none"> • lubrication • inspection • alignment • adjustment <ul style="list-style-type: none"> • Servicing measuring tools and accessories e.g. <ul style="list-style-type: none"> • Cleaning • Oiling • Painting <input type="checkbox"/> Inspection of tools and accessories	<ul style="list-style-type: none"> • Observation • Oral questioning • Practical exercise • Written tests
9. Perform housekeeping	<ul style="list-style-type: none"> • Cleaning of work environment (waste sorting and disposal) • Cleaning of tools • Storing of tools and equipment 	<ul style="list-style-type: none"> • Observation • Oral questioning • Practical exercise • Written tests
10. Document Report	<input type="checkbox"/> Defects/ deviations report <input type="checkbox"/> Cost variations report <input type="checkbox"/> Accidents and incidents report xxx	<input type="checkbox"/> Oral questions <input type="checkbox"/> Written tests <input type="checkbox"/> Practical test <input type="checkbox"/> Observation

Suggested Methods of Delivery

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

Recommended Resources

- Milling machine
- Milling cutters
- Measuring tools
- Stock material

- Resource materials, manuals for cutting tools and milling machine
- Computers
- Projectors
- Manuals
- Printers
- Any other relevant resources
- Occupational safety and health act (OSHA)
- Work injury benefits act(WIBA)
- KEBS standards