

**REPUBLIC OF KENYA**

**COMPETENCY BASED CURRICULUM**

**FOR**

**PLANT AND SERVICE 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 mechanical 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 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.

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

**DR. LAWRENCE GUANTAI M’ITONGA, PhD**

**COUNCIL SECRETARY/CEO**

**TVET CDACC**

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**ACRONYMNS AND ABBREVIATIONS**

CDACC Curriculum Development, Assessment and Certification Council

EBK Engineers Board of Kenya

EBP Engineering best practice

EHS Environment, Health and Safety

IEE Institute of Electrical Engineers

IBMS Integrated Building Management System

KEBS Kenya Bureau of Standards

NCA National Construction Authority

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

PS Plant and Service

BC Basic Competencies

CC Common Competencies

CR Core Competencies

A Control Version

**KEY TO UNIT CODE**

ENG/CU/PS/BC/01/4/A

Industry or sector

Curriculum

Occupational area

Type of competency

Competency number

Competency level

Control version

**OVERVIEW**

**Description of the course**

This course is designed to equip a mechanical plant and service artisan with the competencies required to perform various duties as outlined in the curriculum in the mechanical sector.

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/PS/BC/01/4/A | Communication skills | 20 | 2 |
| ENG/CU/PS/BC/02/4/A | Digital Literacy | 30 | 3 |
| ENG/CU/PS/BC/03/4/A | Entrepreneurial skills | 60 | 6 |
| ENG/CU/PS/BC/04/4/A | Employability skills | 30 | 3 |
| ENG/CU/PS/BC/05/4/A | Environmental literacy | 20 | 2 |
| ENG/CU/PS/BC/06/4/A | Occupational safety and health practices | 20 | 2 |
| **Total** | | **180** | **18** |

**Common Units of Learning**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Duration in Hours** | **Credit Factors** |
| ENG/CU/PS/CC/01/4/A | Mathematics | 30 | 3 |
| ENG/CU/PS/CC/02/4/A | Workshop process and material | 20 | 2 |
| ENG/CU/PS/CC/03/4/A | Mechanical science principle | 30 | 3 |
| ENG/CU/PS/CC/04/4/A | Material science and metallurgical process | 30 | 3 |
| ENG/CU/PS/CC/05/4/A | Electrical principles | 30 | 3 |
| ENG/CU/PS/CC/06/4/A | Technical Drawing | 20 | 2 |
| **Total** | | **160** | **16** |

**Core Units of Learning**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Duration in Hours** | **Credit Factors** |
| ENG/CU/PS/CC/01/4/A | Installation of mechanical pumps | 60 | 6 |
| ENG/CU/PS/CC/02/4/A | Hydraulic and pneumatic systems | 60 | 6 |
| ENG/CU/PS/CC/03/4/A | Operation and maintenance of plant machinery | 60 | 6 |
| ENG/CU/PS/CC/04/4/A | Refrigeration and air conditioning system | 60 | 6 |
|  | Industrial Attachment | 360 | 36 |
| **Total** | | **600** | **60** |
| **Grand Total** | | **940** | **94** |

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

The total duration of the course is **940 hours** (31 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.)

**Or**

1. Level 3 certificate in Plant and service mechanic or related course with **one** year of continuous work experience

**Or**

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

**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 360 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 Plant and Service Artisan 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/PS/BC/01/4/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Demonstrate communication skills

**Duration of Unit:** 20hours

**Unit Description**

This unit describes the competencies required to use specialized communication skills to meet specific needs of internal and external clients, conduct interviews, facilitate discussion with groups and contribute to the development of communication strategies.

**Summary of Learning Outcomes**

1. Utilize specialized communication skills processes
2. Contribute to the development of communication strategies
3. Conduct interviews
4. Facilitate group discussions
5. Represent the organization

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Utilize specialized communication skills 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 * Active listening * Feedback * Interpretation * Flexibility in communication | * Observation * Oral * Written tests * Practical tests |
| 1. Contribute to the development of communication strategies | * Dynamics of groups * Styles of group leadership * Openness and flexibility in communication * Communication skills relevant to client groups | * Observation * Oral * Written tests * Practical tests |
| 1. Conduct interviews | * Types of interview * Establishing rapport * Facilitating resolution of issues * Developing action plans | * Observation * Oral * Written tests * Practical tests |
| 1. Facilitate group discussions | * Identification of communication needs * Dynamics of groups * Styles of group leadership * Presentation of information * Encouraging group members participation * Evaluating group communication strategies | * Observation * Oral * Written tests * Practical tests |
| 1. Represent the organization | * Presentation techniques * Development of a presentation * Multi-media utilization in presentation * Communication skills relevant to client groups | * Observation * Oral * Written tests * Practical tests |

**Suggested Delivery Methods**

* Interview
* Role playing
* Observation
* Viewing of related videos

**Recommended Resources**

* Desktop computers/laptops
* Internet connection
* Projectors
* Telephone

**DIGITAL LITERACY**

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

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate digital literacy

**Duration of Unit:** 30 hours

**Unit Description**

This unit describes competencies required to use a computer and other digital devices for the purposes of communication, work performance and management at the workplace.

**Summary of Learning Outcomes**

1. Identify computer software and hardware
2. Apply security measures to data, hardware, software in automated environment
3. Apply computer software in solving tasks
4. Apply internet and email in communication at workplace
5. Apply desktop publishing in official assignments
6. Prepare presentation packages

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Identify computer hardware and software | * Concepts of ICT * Functions of ICT * History of computers * Components of a computer * Classification of computers | * Written tests * Oral presentation * 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 * Laws governing protection of ICT | * Written tests * Oral presentation * Observation * Project |
| 1. Apply computer software in solving tasks | * Operating system * Word processing * Spread sheets * Data base design and manipulation * Data manipulation, storage and retrieval | * Oral questioning * Observation * Project |
| 1. Apply internet and email in communication at workplace | * Computer networks * Network configurations * Uses of internet * Electronic mail (e-mail) concept | * Oral questioning * Observation * Oral presentation * Written report |
| 1. Apply desktop publishing in official assignments | * Concept of desktop publishing * Opening publication window * Identifying different tools and tool bars * Determining page layout * Opening, saving and closing files * Drawing various shapes using DTP * Using colour pellets to enhance a document * Inserting text frames * Importing and exporting text * Object linking and embedding * Designing of various publications * Printing of various publications | * Oral questioning * Observation * Oral presentation * Written report * Project |
| 1. Prepare presentation packages | * Types of presentation packages * Procedure of creating slides * Formatting slides * Presentation of slides * Procedure for editing objects | * Oral questioning * Observation * Oral presentation * Written report * Project |

**Suggested Delivery Methods**

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

**Recommended Resources**

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

**ENTREPRENEURIAL SKILLS**

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

**Relationship to occupational standards**

This unit addresses the unit of competency: Demonstrate entrepreneurial skills

**Duration of unit:** 60 hours

**Unit description**

This unit describes the competencies critical to demonstration of entrepreneurial capabilities. It involves, enhancing the entrepreneur’s business skills, fostering a culture of continuous improvement at individual and organization level, implementing appropriate internal controls for profitability, improving employed capital base and undertaking regional/county business expansion.

**Summary of Learning Outcomes**

1. Develop one’s business skill
2. Develop individual workers and teams
3. Expand markets and customers
4. Expand employed capital
5. Undertake regional/county business expansion

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Develop one’s business skill | * Entrepreneurial skills development * Market trends * Monitoring and anticipating market trends * New technologies in entrepreneurship * Products and processes in entrepreneurship * Linkages with other entrepreneurs * Business conventions ad exhibitions * Personal improvement and growth | * Observation * Case studies * Individual/group assignments * Projects * Written * Oral |
| 1. Develop individual workers and teams | * Good staff/workers * Team building and team work * Staff development and enhancement * Culture of continuous improvement * Increasing products and services * Marketing improvement * Entrepreneurship | * Observation * Case studies * Individual/group assignments * projects * Written * Oral |
| 1. Expand markets and customers base | * Maintaining appropriate cash flow in the organization * Internal controls * Business break-even point * Business profitability determinants * Prudent purchases in an enterprise * Reducing business expenses * Good staff/workers and customer relations * Identifying and maintain new customers and markets * Product/ service promotions * Products / services diversification * SWOT / PESTEL analysis * Conducting a business survey * Market expansion * 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 * Observation * Case studies * Individual/group assignments * projects * Written |
| 1. Expand employed capital | * Employed capital in small businesses * Share holdings * Business expansion and diversification * Resources for growing small business * Small business Strategic Plan * Cooperate Social responsibility * Computer software in business development * ICT and business growth | * Observation * Case studies * Individual/group assignments * projects * Written |
| 1. Undertake county/regional business expansion | * Region identification process * Regional laws and regulation * Business regional expansion requirements | * Oral * Observation * Case studies * Individual/group assignments * projects * Written |

**Suggested Delivery Methods**

* 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/PO/BC/04/4/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate employability skills

**Duration of Unit:**  30 hours

**Unit Description**

This unit covers competencies required to demonstrate employability skills. It involves competencies for exuding self-awareness and ability to deal with everyday life challenges; demonstrating critical safe work habits and leading a workplace team; planning and organizing work activities; applying learning, creativity and innovativeness in workplace functions; pursuing professional growth and managing time effectively in the workplace.

**Summary of Learning Outcomes**

1. Develop self-awareness and ability to deal with life challenges
2. Demonstrate critical safe work habits for employees
3. Lead a workplace team
4. Plan and organize work
5. Maintain professional growth and development in the workplace.
6. Demonstrate learning, creativity and innovativeness in the workplace.

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Develop self-awareness and ability to deal with life challenges | * Self-awareness * Formulating personal vision, mission and goals * Strategies for overcoming life challenges * Managing emotions * Emotional intelligence * Asserting one-self * Assertiveness versus aggressiveness * Expressing personal thoughts, feelings and beliefs * Self esteem * Developing and maintaining high self-esteem * Developing and maintaining positive self-image * Sharing personal feelings * Setting performance targets * Monitoring and evaluating performance * Articulating ideas and aspirations * Accountability and responsibility | * Observation * Written * Oral interview * Third party report |
| 1. Demonstrate critical safe work habits for employees | * Stress and stress management * Time concept * Punctuality and time consciousness * Leisure * Integratingpersonal objectives into organizational objectives * Resources mobilization * Resources utilization * Setting work priorities * Developing healthy relationships * HIV and AIDS * Drug and substance abuse * Dealing with emerging issues | * Observation * Written * Oral interview * Third party report |
| 1. Lead a workplace team | * Leadership * Influence * Team building * Determination of team roles and objectives * Team parameters and relationships * Individual responsibilities in a team * Forms of communication * Business communication * Complementing team activities * Gender and gender mainstreaming * Human rights protocols * Developing healthy relationships * Maintaining relationships * Conflicts and conflict resolution | * Observation * Oral interview * Written * Third party report |
| 1. Plan and organize work | * Planning * Organizing * Schedules of activities * Developing work plans * Developing work goals/objectives and deliverables * Monitoring work activities * Evaluating work activities * Resource mobilization * Resource allocation * Resource utilization * Decision making * Problem solving * Negotiation | * Observation * Oral interview * Written * Third party report |
| 1. Maintain professional growth and development in the workplace | * Avenues for professional growth * Training and career opportunities * Assessing training needs * Mobilizing training resources * Licenses and certifications for professional growth and development * Pursuing personal and organizational goals * Managing work priorities and commitments * Recognizing career advancement | * Observation * Oral interview * Written * Third party report |
| 1. Demonstrate learning, creativity and innovativeness in the workplace | * Managing own learning * Mentoring * Coaching * Networking * Variety of learning context * Application of learning * Safe use of technology * Taking initiative/proactive * Flexibility * Identifying opportunities * Generating new ideas * Workplace innovation * Performance improvement | * Observation * Oral interview * Written * Third party report |

**Suggested Methods of Delivery**

* Instructor lead facilitation of theory
* Demonstrations
* Simulation/Role play
* Group Discussion
* Presentations
* Projects
* Case studies
* Assignments

**Recommended Resources**

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

**ENVIRONMENTAL LITERACY**

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

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Demonstrate environmental literacy

**Duration of Unit:** 20 hours

**Unit Description**

This unit describes the competencies required to control environmental hazard, control environmental pollution, comply with workplace sustainable resource use, evaluate current practices in relation to resource usage, identify environmental legislations/conventions for environmental concerns, implement specific environmental programs and monitor activities on environmental protection/programs.

**Summary of Learning Outcomes**

1. Control environmental hazard
2. Control environmental Pollution
3. Demonstrate sustainable resource use
4. Evaluate current practices in relation to resource usage
5. Identify Environmental legislations/conventions for environmental concerns
6. Implement specific environmental programs
7. Monitor activities on Environmental protection/Programs

**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 questions * Oral questions * Observation of work procedures |
| 1. Control environmental Pollution control | * 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 questions * 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 questions * Oral questions * Observation of work procedures * Role play |
| 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 questions * Oral questions * Observation of work procedures * Role play |
| 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 questions * Oral questions * Observation of work procedures |
| 1. Implement specific environmental programs | * Community needs and expectations * Resource availability * 5 s of good housekeeping * Identification of programs/Activities * Setting of individual roles /responsibilities * Resolving problems /constraints encountered * Consultation with stakeholders | * Written questions * Oral questions * Observation of work procedures * Role play |
| 1. Monitor activities on Environmental protection/Programs | * Periodic monitoring and Evaluation of activities * Gathering feedback from stakeholders * Analysing data gathered * Documentation of recommendations and submission * Setting of management support systems to sustain and enhance the program * Monitoring and reporting of environmental incidents to concerned /proper authorities | * Oral questions * Written tests * Practical test * Observation |

**Suggested Delivery Methods**

* 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
* Environmental Management and Coordination Act 1999
* Machine/equipment manufacturer’s specifications and instructions
* Personal Protective Equipment (PPE)
* ISO standards
* Company environmental management systems (EMS)
* Montreal Protocol
* Kyoto Protocol

**OCCUPATIONAL SAFETY AND HEALTH PRACTICES**

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

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Demonstrate occupational safety and health practices

**Duration of Unit:** 20 hours

**Unit Description**

This unit describes the competencies required to comply with regulatory and organizational requirements for occupational safety and health.

**Summary of Learning Outcomes**

1. Identify workplace hazards and risk
2. Identify and implement appropriate control measures to hazards and risks
3. Implement OSH programs, procedures and policies/guidelines

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Identify workplace hazards and risks | * Identification of hazards in the workplace and/or the indicators of their presence * Evaluation and/or work environment measurements of OSH hazards/risk existing in the workplace is conducted by * Authorized personnel or agency * Gathering of OHS issues and/or concerns raised | * Oral questions * Written tests * Observation of trainees identify hazards and risks |
| 1. Identify and implement appropriate control measure to hazards and risks | * Prevention and control measures, including use of PPE (personal protective equipment) for specific hazards are identified and implemented * Appropriate risk controls based on result of OSH hazard evaluation is recommended * Contingency measures, including emergency procedures during workplace incidents and emergencies are recognized and established in accordance with organization procedures | * Oral questions * Written tests * Practical test * Observation of implementation of control measures |
| 1. Implement OSH   programs, procedures  and policies/guidelines | * Providing information to work team about company OHS program, procedures and policies/guidelines * Participating in implementation of OSH procedures and policies/ guidelines * Training of team members and advice on OSH standards and procedures * Implementation of procedures for maintaining OSH-related records | * Oral questions * Written tests * Practical test * Observation |

**Suggested Delivery Methods**

* 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

**COMMON UNITS OF LEARNING**

**MATHEMATICS**

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

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Apply mathematics

**Duration of Unit:** 30hours

**Unit Description**

This unit describes the competencies required by a worker in order to apply a wide range of mathematical calculations for work; apply ratios and proportions to solve problems; perform geometrical calculations; apply concepts of probability for work; perform commercial calculations and collect, organize and analyze statistical data.

**Summary of Learning Outcomes**

1. Apply a wide range of mathematical calculations for work
2. Apply ratios and proportions to solve problems
3. Perform geometrical calculations
4. Apply concepts of probability for work
5. Perform commercial calculations
6. Collect and present data
7. Apply measures of central tendency in work
8. Apply measures of dispersion in work
9. Apply sampling in work

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

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Apply a wide range of mathematical calculations for work | * Fundamentals of mathematics * Addition, subtraction, multiplication and division of positive and negative numbers * Algebraic expressions manipulation | * Written tests * Assignments * Supervised exercises * Written tests |
| 1. Apply ratios and proportions to solve problems | * Ratios and proportions * Meaning * Conversions into percentages * Direct and inverse proportions determination | * Written tests * Oral questioning * Assignments * Supervised exercises |
| 1. Perform geometrical calculations | * Units of measurements and their symbols * Conversion of units of measurement * Perimeters of regular figures * Areas of regular figures * Volumes of regular figures | * Assignments * Supervised exercises * Written tests |
| 1. Apply concepts of probability for work | * + Meaning of probability   + Types of probability events * Dependent * Independent * Mutually exclusive   + Laws of probability   + Counting techniques * Permutation * Combination * Tree diagrams | * Written tests * Assignments * Supervised exercises |
| 1. Perform commercial calculations | * + Conversion of one currency to another   + Exchange rates calculation * Devaluation * Revaluation   + Product pricing   + Profit calculation   + Average sales determination   + Stock turnover   + Calculation of incomes   + Salaries * Gross * Net   + Wages * Time rate * Flat rate and overtime * Piece rate * Commission * Percentage * Bonus | * Oral * Written tests * Assignments * Supervised exercises |
| 1. Collect and present data | * + Classification of data * Grouped data * Ungrouped data   + Data collection * Observation * Recording   + Tabulation of data * Class intervals * Class boundaries * Frequency tables * Cumulative frequency   + Diagrammatic and graphical presentation of data e.g. * Histograms * Frequency polygons * Bar charts * Pie charts * Cumulative frequency curves | * Assignments * Supervised exercises * Written tests |
| 1. Apply measures of central tendency in work | * + Meaning of measures of central tendency   + Measures * Properties * Calculation and interpretation of mean, mode and median | * Written tests * Oral * Supervised exercises |
| 1. Apply measures of dispersion in work | * + Meaning of measures of dispersion   + Types, merits and demerits of absolute and relative measures   + Calculation and interpretation of measures of dispersion * Range * Mean deviation * Quartiles, deciles, percentiles and interquartile range * Variance and standard deviation | * Assignments * Supervised exercises * Written tests |
| 1. Apply sampling in work | * + Distinguishing between sampling and census   + Importance of sampling   + Errors in sampling   + Types of sampling and their limitations e.g. * Stratified random * Cluster * Judgmental | * Written tests * Oral * Reports |

**Suggested Delivery Methods**

* Group discussions
* Demonstration by trainer
* Practical work by trainee
* Exercises

**Recommended Resources**

* Calculators
* Rulers, pencils, erasers
* Charts with presentations of data
* Graph books
* Dice
* Internet

**WORKSHOP TECHNOLOGY PRACTICES**

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

**Relationship to Occupational Standards**:

This unit addresses the unit of competency: Apply workshop technology principles

Duration of Unit: 60 Hours

**Unit description**

This unit describes the competencies required by an automotive technician in order to apply a wide range of workshop technology skills in their work. It involves use of different methods to produce work pieces using basic tools while observing occupational safety and health legislations, regulations and safe working practices, interpret working drawings, select appropriate techniques for a given task to achieve specified results as well as perform housekeeping.

**Summary of Learning Outcome**

1. Interpreting working drawings
2. Choosing of appropriate tools and materials.
3. Marking out of the work pieces
4. Producing components as per the drawing
5. Performing finishing processes
6. Assembling produced parts
7. Performing housekeeping

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

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Interpreting working drawings | * Reading and extraction of information (dimensions, tolerances, BS/ANSI Drawing Standards, geometric ISO symbols & abbreviations) * Development of working procedure/ operational plan | * Administration of written and oral tests * Assessment of worksheet/ operation plans |
| 1. Choose appropriate tools and materials | * Types of hand tools * Using hand tools. * Using machine tools * Selection of tools as per the specific operation * Inspection and/or recalibration of tools * Demonstration of correct handling of tools. * Selection of material for the given component | * Observation of correct selection of tools for specific operation * Observation of inspection and/or recalibration of tools * Observation of appropriate handling of tools * Administration of oral and written questions |
| 1. Marking out of work piece(s) | * 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. Producing components as per the drawing | * Set up work piece on work holding device securely. * Perform suggested operations but not limited to: * Tapping * Drilling * boring * Filing * Grinding * Sawing * Turning * Soldering/brazing * welding * Finishing Activities * Polishing * Filing * Grinding * de-burring * painting of components * Joining and fitting | * Use of correct procedure * Assessment of the produced component |
| 1. Performing housekeeping | * Cleaning of work environment (waste sorting and disposal) * Cleaning and storing of tools and equipment * Servicing and maintenance of machine (lubrication, inspection, alignment and adjustment) | * Observation of servicing and maintenance of the machine * Observation of clean working environment * Observation clean and stored tools and equipment |
| 1. Maintain tools and equipment | * Meaning of terms * Workshop rules and practices * Machine maintenance activities * Maintenance of hand and machine tools and equipment e.g. * Cleaning * Oiling * Painting * Basic inspection * Storage |  |

**Suggested Delivery Methods**

* Demonstration by trainer
* Discussions
* 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
* Burnishing machine
* 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
* Vacuum cleaners
* Mops/ Brooms and buckets
* 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

**PRINCIPLES OF MECHANICAL SCIENCE**

**UNIT CODE:** ENG/CU/PS/CC/03/4/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Apply principles of mechanical science

**Duration of Unit:** 30 hours

**Unit Description**

This unit describes the competencies required by a technician in order to apply a wide range of Mechanical science principles in their work. It includes using concepts of mechanical science, determining effects of loading on static and dynamic engineering systems, analyse properties of materials, determine parameters of a fluid system and use of basic systems in power transfer.

**Summary of Learning Outcomes**

1. Use the concept of mechanical science
2. Demonstrate understanding of friction
3. Determine parameters of a fluid system
4. Demonstrate knowledge of moments
5. Apply heat knowledge
6. Use of basic mechanical systems in power transfer

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Use the concept of mechanical science | * Define work, force, mechanical advantage and efficiency * Type of forces * Resolution of forces * Resultant force and equilibrium * Moments of a force * Newton’s laws of motion * Displacement, Velocity and acceleration * Work, Energy and Power | * Written tests * Oral questioning * Assignments * Supervised exercises |
| 1. Demonstrate knowledge of moments | * Meaning of terms * Determination of moments * Principle of moments * Couples | * Assignments * Oral questioning * Practical tests * Observation * Supervised exercises * Written tests |
| 1. Demonstrate understanding of friction | * Meaning of terms * Laws of friction * Limiting friction * Coefficient of friction * Advantages and disadvantages of friction * Forces of friction | * Assignments * Oral questioning * Practical tests * Observation * Supervised exercises * Written tests |
| 1. Determine parameters of a fluid system | * Meaning of terms * Discussion of Pascal’s principles * Measuring fluid parameters * Gas laws * Fluid properties * Description and determination of fluid parameters | * Assignments * Oral questioning * Practical tests * Observation * Supervised exercises * Written tests |
| 1. Apply heat knowledge | * Meaning of terms * Working principles of heat * Temperature and its measurements * Heat capacity calculations | * Assignments * Oral questioning * Practical tests * Observation * Supervised exercises * Written tests |
| 1. Use of basic mechanical systems in power transfer | * + Meaning of terms and simple machines   + Uses and working principle of Gear trains   + Uses and working principles of Pulley system, hoists and lifts   + Uses and working principles of screws | * Assignments * Supervised exercises * Written tests * Practical test |

**Suggested Delivery Methods**

* Group discussions
* Demonstration by trainer
* Online video clips
* Power point presentation
* Exercises by trainee

**Recommended Resources**

* Scientific Calculators
* Relevant reference materials
* Stationeries
* Electrical workshop
* Relevant practical materials
* Dice
* Computers with internet connection

**MATERIAL SCIENCE AND METALLURGICAL PROCESSES**

**UNIT CODE:** ENG/CU/PS/CC/04/4/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Apply material science and perform metallurgical processes

**Duration of Unit:** 30 hours

**Unit Description:**

This unit cl covers the unit of competency: Apply material science and metallurgical processes. It include: analysing properties of engineering materials, performing ore extraction processes, producing materials, performing heat treatment and preventing material corrosion.

**Summary of Learning Outcomes**

1. Analyse properties of engineering materials
2. Perform ore extraction processes
3. Produce materials
4. Perform heat treatment
5. Prevent material corrosion

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| * 1. Analyse properties of engineering materials | * + Engineering materials are identified as per the procedures   + Physical properties of engineering material   + Mechanical properties of engineering materials * Crystal structure of materials | * Written tests * Oral questioning * Assignments * Supervised exercises |
| * 1. Perform ore extraction processes | * Safety measures in metal extraction * Method of metal extraction * Procedure in metal extraction processes * Storing of metal Extraction by- products * Disposing extraction by- products | * Written tests * Oral questioning * Assignments * Supervised exercises |
| * 1. Produce materials | * Meaning of terms * Types of materials e.g. * Iron * Non-ferrous * Alloys * Ceramics * Composite * Methods of material production and testing * Finishing and Refinement processes of various types of materials | * Assignments * Oral questioning * Supervised exercises * Written tests |
| 1. Perform heat treatment | * + Safety practices procedures   + Heat treatment processes   + 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 | * Assignments * Supervised exercises * Written tests * Practical test |

**Suggested Delivery Methods**

* 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

* 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

**ELECTRICAL PRINCIPLES**

**UNIT CODE:** ENG/CU/PS/CC/05/4/A

**Relationship to Occupational Standards**

This unit **addresses** the unit of competency: Apply Electrical principles

**Duration of Unit:** 30 hours

**Unit Description**

This unit describes the competencies required by a technician in order to apply a wide range of Electrical principles in their work; use the concept of basic Electrical quantities, use the concepts of D.C and A.C circuits in electrical installation, use of basic electrical machine, use of earthing in Electrical installations and apply lightning protection measures

**Summary of Learning Outcomes**

1. Use the concept of basic Electrical quantities
2. Use the concepts of D.C and A.C circuits in electrical installation
3. Use of basic electrical machine
4. Use of earthing in Electrical installations
5. Apply lightning protection measures
6. Demonstrate understanding of Refrigeration and Air conditioning

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| * + 1. Use the concept of basic Electrical quantities | * The meaning of SI unit * SI unit of various types of Electrical parameters * Ohm’s law * Calculations involving various Electrical parameters e.g. * Power * Current * Voltage * Resistance * Instruments used in measuring various types of Electrical parameters | * Written tests * Oral questioning * Assignments * Supervised exercises |
| * + 1. Use the concepts of D.C and A.C circuits in electrical installation | * Meaning of terms * AC and DC, parallel and series circuits * AC and DC network theorems | * Written tests * Oral questioning * Assignments * Supervised exercises |
| * + 1. Use of basic electrical machine | * Types of Electrical machines * DC machines, * AC Single and three phase motors, generators and Transformers * Application of AC and DC machines | * Assignments * Oral questioning * Supervised exercises * Written tests * Practical tests |
| * + 1. Use of earthing in Electrical installations | * + Meaning of Earthing   + Terms in Earthing   + Earthing points in Electrical installation   + Methods of earthing   + Factors to consider in selecting an earthing method   + Testing an earthing system | * Assignments * Supervised exercises * Written tests * Practical test |
| * + 1. Apply lightning protection measures | * + Meaning of lightning   + Lightning strokes and their types   + Lightning protection components   + Testing a lightning system   + Application of lightning system   + Maintenance of lightning system | * Assignments * Oral questioning * Supervised exercises * Written tests |

**Suggested Delivery Methods**

* Group discussions
* Demonstration by trainer
* Exercises by trainee

**Recommended Resources**

* Scientific Calculators
* Relevant reference materials
* Stationeries
* Electrical workshop
* Relevant practical materials
* Dice
* Computers with internet connection

**TECHNICAL DRAWING**

**UNIT CODE:** ENG/CU/PS/CC/06/4/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Prepare and interpret technical drawings

**Duration of Unit:** 20hours

**Unit Description**

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

**Summary of Learning Outcomes**

1. Use and maintain drawing equipment and materials
2. Produce plane geometry drawings
3. Produce solid geometry drawings
4. Produce pictorial and orthographic drawings of components
5. Apply CAD packages

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

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Use and maintain drawing equipment 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. Produce 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 | * Written test * Observation * Oral questioning * Written tests |
| 1. Produce solid geometry drawings | * Interpretation of sketches and drawings of patterns e.g. prisms, cones. pies, frustrums 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. Produce orthographic drawings | * Meaning of pictorial and orthographic drawings * Meaning of sectioning * Meaning of symbols and abbreviations * Drawing and interpretation of orthographic elevations * Dimensioning of orthographic elevations * Sectioning of views | * Written test * Observation * Oral questioning * Written tests |
| 1. Produce pictorial drawings | * Meaning of pictorial drawings * Drawing objects in isometric view * Drawing objects in oblique view | * Written test * Observation * Oral questioning * Written tests |
| 1. Produce mechanical drawings | * Mechanical symbols and abbreviations * Meaning of mechanical drawings * Drawing of mechanical diagrams | * Written test * Observation * Oral questioning * Written tests |
| 1. Apply CAD packages | * Identification of CAD packages e.g. AutoCAD, circuit maker * Use of CAD packages in drawing of: * Plane geometry * Solid * Orthographic * Pictorial | * Written test * Observation * Oral questioning * Written tests |

**Suggested Methods of Delivery**

* 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
* Computers installed with relevant CAD packages

# COMMON UNITS OF LEARNING

# INSTALLATION OF MECHANICAL PUMPS AND COMPRESSORS

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

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Install mechanical pumps and compressors

**Duration of Unit:** 60 hours

**Unit Description**

This unit covers the competencies required to install mechanical pumps and compressor. Competencies include; Installing mechanical pumps and compressors, installing prime movers, aligning prime mover and pump/compressor and test running installed prime mover and pump/compressors assembly.

**Summary of Learning Outcomes**

1. Install mechanical pumps and compressors
2. Install prime movers
3. Align prime mover and pump/compressor
4. Test run installed prime mover and pump/compressors assembly.

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

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Install pumps and compressors | * Safety measures, rules and regulations are adhered to in installation. * Tools and equipment used in pump and compressors installation * Types of fasteners and fitting in pumps and compressors installation * Test run installed pumps and compressors | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Install prime movers | * Safety measures, rules and regulations are adhered to in installation * Tools, equipment and materials in used in installation of prime movers * Types of fasteners and fitting in prime movers’ installations * Installation alignment of prime mover and pumps/compressors | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Align prime mover and pump/compressor assembly. | * Safety measures, rules and regulations are adhered to in alignment * Tools, equipment and materials in used in assembly alignment * Carry out alignment. | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Test run installed prime mover and pump/compressors assembly. | * Safety measures, rules and regulations are adhered to in test running. * Tools, equipment and materials in used in test running. * Various types of checks carried out after pump and compressor installation * Test run installed prime mover and pumps/compressors assembly. * Various pump and compressors installation adjustments * Basic pump and compressor installation maintenance | * Observation * Oral questioning * Practical tests * Written tests |

**Suggested Methods of Delivery**

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

**Recommended Resources**

* Stationery
* Projectors
* Computers
* Manuals
* Printers
* Internet
* Alignment equipment
* Occupational Safety and Health Act (OSHA)
* National Environmental Management Authority (NEMA) regulations
* National Construction Authority (NCA) regulations
* Other relevant resources

# INSTALLATION OF HYDRAULIC AND PNEUMATIC SYSTEMS

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

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Installation of hydraulic and pneumatic systems

**Duration of Unit:** 60 hours

**Unit Description**

This unit covers the competencies required to install hydraulic and pneumatic systems. Competencies include; preparing installation components, installing components and performing basic test.

**Summary of Learning Outcomes**

1. Prepare installation components
2. Install components
3. Perform basic test

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

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Prepare installation components | * Safety factors on component handling. * Tools, equipment and materials in used in preparation. * Components of Hydraulic & Pneumatic system assembled. | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Install components | * Safety in installation of components * Tools, equipment and materials used in component installation. * Installation as per workplace procedures * Inspection of installed system | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Perform basic test | * Safety measures, rules and regulations are adhered to in testing * Types of tests e.g. * Leakage * Noise level | * Observation * Oral questioning * Practical tests * Written tests |

**Suggested Methods of Delivery**

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

**Recommended Resources**

* Stationery
* Computers
* Projectors
* Manuals
* Printers
* Any other relevant resources
* Occupational safety and health act (OSHA)
* Work injury benefits act(WIBA)
* KEBS standards

**OPERATION AND MAINTENANCE OF PLANT MACHINERY**

**UNIT CODE:** ENG/CU/PS/CR/03/4/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Operate and maintain plant machinery.

**Duration of Unit:** 60 hours

**Unit Description**

This unit covers the competencies required in to operate and maintain plant machinery. Competencies include; operating plant machinery, maintaining plant machinery and test running the plant machinery.

**Summary of Learning Outcomes**

* + 1. Operate plant machinery
    2. Maintain plant machinery
    3. Test run the plant machinery

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

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Operate plant machinery | * Safety, checks and precautions in the operation of the machine * Tools, equipment and materials for operation of the plant machinery * Prepare plant machinery for operation * Pre-operational checks * Operation procedures of plant machinery * Post-operational checks | * Observation * Oral questioning * Written tests * Practical tests |
| 1. Maintain plant machinery | * Safety measures in machine maintenance * **CUT OUT/ LOCK OUT** of plant machinery * Prepare tools, equipment and materials for maintenance in plant machinery. * Prepare plant machinery for maintenance as per workplace procedures * Maintain plant machinery as per workplace maintenance procedures | * Observation * Oral questioning * Written tests * Practical tests |
| 3. Test run the plant machinery | * Safety measures, rules and regulations on test running to be adhered to. * Tools and equipment for test running to be assembled and used as per workplace procedures * Preparation for test running as per workplace procedures. * Test running to be carried out as per workplace procedures. | * Observation * Oral questioning * Written tests * Practical tests |

**Suggested Methods of Delivery**

* Discussions
* Site visits
* On-job-training
* Charts and Audio-visual presentations

**Recommended Resources**

* Computers
* Printers
* Cameras
* Stationery

**INSTALLATION OF REFRIGERATION AND AIR CONDITIONING SYSTEMS**

**UNIT CODE:** ENG/CU/PS/CR/04/4/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Install refrigeration and air conditioning system

**Duration of Unit:** 60 hours

**Unit Description**

This unit covers the competencies required to install refrigeration and air conditioning system. Competencies include; assembling tools, equipment and materials, conducting basic electrical wiring, servicing and test running of refrigeration and air conditioning systems.

**Summary of Learning Outcomes**

1. Assemble refrigeration and air conditioning tools, equipment and materials
2. Conduct basic electrical wiring for refrigeration and air conditioning systems
3. Service refrigeration and air conditioning systems
4. Test Run serviced refrigeration and air conditioning

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

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Assemble refrigeration and air conditioning tools, equipment and materials | * Safety measures, rules and regulations in assembly. * Tools, equipment and materials in assembly e.g. * Gauge manifold * Flaring tools * Swaging tools * Pipe cutters * Pipe bending tools * Refrigerants * Refrigerant cylinder * Ducts material * Tools configuration * Material assembling techniques | * Observation * Oral questioning * Written tests * Practical tests |
| 1. Conduct basic electrical wiring for refrigeration and air conditioning systems | * Safety measures, rules and regulations in basic electrical wiring. * Tools, equipment and materials in basic electrical wiring. * Basic wiring systems in refrigeration and air conditioning | * Observation * Oral questioning * Written tests * Practical tests |
| 1. Service refrigeration and air conditioning systems | * Safety measures and precautions during service of refrigeration and air conditioning * Tools, equipment and materials in servicing. * Service procedures for refrigeration and air conditioning * Various types of checks carried out after servicing of refrigeration and air conditioning systems | * Observation * Oral questioning * Written tests * Practical tests |
| 1. Test Run serviced refrigeration and air conditioning | * Safety involved in test run. * Test run serviced refrigeration and air conditioning systems. * Tools, equipment and materials in test running * Various refrigeration and air conditioning systems adjustments after service. | * Observation * Oral questioning * Written tests * Practical tests |

**Suggested Methods of Delivery**

* Demonstration by trainer
* Practice by the trainee
* Field trips
* Discussions

**Recommended Resources**

* Stationery
* Computers
* Projectors
* Printers
* Manuals
* Relevant catalogues

# PERFORM PLANT MAINTENANCE

**UNIT CODE:** ENG/OS/PS/CR/05/4/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Perform plant maintenance

**Duration of Unit:** 60 hours

**Unit Description**

This unit covers the competencies required to perform plant maintenance. Competencies includes: Assembling maintenance tools, equipment and materials, decommissioning plant equipment to be maintained and carrying out maintenance and test running.

**Summary of Learning Outcomes**

1. Assemble maintenance tools, equipment and materials
2. Decommission plant equipment to be maintained
3. Carry out maintenance
4. Test run

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

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Assemble maintenance tools, equipment and materials | * Safety in handling tools, equipment and materials * Setting of tools and equipment * Maintenance tools, equipment and materials * Assembling of maintenance materials | * Observation * Written tests * Oral questioning |
| 1. Decommission plant equipment to be maintained | * Safety rules in plant decommissioning * Tools, equipment and materials in decommissioning * Plant decommissioning procedures | * Oral questioning * Written tests * Practical test |
| 1. Carry out maintenance | * Safety in plant maintenance * Tools, equipment and materials in maintenance. * Use checklist in plant maintenance * Basic fault diagnosis procedures * Maintenance activities e.g * Cleaning * Oiling * Greasing * Service and repair * Plant Maintenance waste disposal | * Observation * Oral questioning * Written tests |
| 1. Test Run | * Safety involved in test run. * Tools, equipment and materials in test running * Test run the plant. * Adjustments on maintained plant. | * Oral questioning * Written tests * Practical test |

**Suggested Methods of Delivery**

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

**Recommended Resources**

* Computer
* Stationery
* Projectors
* Manuals