

**REPUBLIC OF KENYA**

**COMPETENCY BASED CURRICULUM**

**FOR**

**AGRICULTURAL ENGINEERING LEVEL 6**



TVET CDACC

P.O BOX 15745-00100

NAIROBI

First published 2019

©2019, TVET CDACC

All rights reserved. No part of this curriculum may be reproduced, distributed, or transmitted in any form or by any means, including photocopying, recording, or other electronic or mechanical methods without the prior written permission of the TVET CDACC, except in the case of brief quotations embodied in critical reviews and certain other non-commercial uses permitted by copyright law. For permission requests, write to the Council Secretary/CEO, at the address below:

**Council Secretary/CEO**

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

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

**Email:** [**info@tvetcdacc.go.ke**](mailto:info@tvetcdacc.go.ke)

# FOREWORD

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

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

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

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

**PRINCIPAL SECRETARY, VOCATIONAL AND TECHNICAL TRAINING**

**MINISTRY OF EDUCATION**

# PREFACE

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

The Technical and Vocational Education and Training Act No. 29 of 2013 on Reforming Education and Training in Kenya, emphasized the need toreform curriculum development, assessment and certification. This called for a shift to CBET to address the mismatch between skills acquired through training and skills needed by industry as well as increase the global competitiveness of Kenyan labour force.

The TVET Curriculum Development, Assessment and Certification Council (TVET CDACC), in conjunction with Agricultural Engineering Sector Skills Advisory Committee (SSAC) have developed Occupational Standards for Agricultural Technician. These standards will be the basis for development of competency-based curriculum for Agricultural Engineering Level 6.

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

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

I am grateful to the Council Members, Council Secretariat, Agricultural Engineering SSAC, expert workers and all those who participated in the development of this curriculum.

**CHAIRPERSON, 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 Agricultural Engineering Sector Skills Advisory Committee (SSAC) in ensuring that competencies required by the industry are addressed in this curriculum. I also thank all stakeholders in 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 Engineering Sector acquire competencies that will enable them to perform their work more efficiently.

**COUNCIL SECRETARY/CEO**

**TVET CDACC**

**Table of Contents**

[FOREWORD ii](#_Toc9411711)

[PREFACE iii](#_Toc9411712)

[ACKNOWLEDGEMENT iv](#_Toc9411713)

[ACRONYMNS AND ABBREVIATIONS vi](#_Toc9411714)

[OVERVIEW viii](#_Toc9411715)

[**BASIC UNITS OF LEARNING** 1](#_Toc9411716)

[COMMUNICATION SKILLS 2](#_Toc9411717)

[DIGITAL LITERACY 5](#_Toc9411718)

[ENTREPRENEURIAL SKILLS 8](#_Toc9411719)

[EMPLOYABILITY SKILLS 11](#_Toc9411720)

[ENVIRONMENTAL LITERACY 15](#_Toc9411721)

[OCCUPATIONAL SAFETY AND HEALTH PRACTICES 19](#_Toc9411722)

[**COMMON UNITS OF LEARNING** 21](#_Toc9411723)

[ENGINEERING MATHEMATICS 22](#_Toc9411724)

[WORKSHOP PROCESSES AND MATERIAL 30](#_Toc9411725)

[PRINCIPLES OF MECHANICAL SCIENCE 35](#_Toc9411726)

[FLUID MECHANICS 38](#_Toc9411727)

[THERMODYNAMICS 40](#_Toc9411728)

[MATERIAL SCIENCE AND METALLURGICAL PROCESSES 43](#_Toc9411729)

[ELECTRICAL PRINCIPLES 47](#_Toc9411730)

[TECHNICAL DRAWING 49](#_Toc9411731)

[**CORE UNITS OF LEARNING** 52](#_Toc9411732)

[OPERATION OF AGRICULTURAL AND RELATED PRODUCTION MACHINERY AND EQUIPMENT 53](#_Toc9411733)

[CONSTRUCTION OF FARMSTEAD STRUCTURES AND FARM ROADS 57](#_Toc9411734)

[PRODUCE POST HARVEST ACTIVITIES 60](#_Toc9411735)

[SOIL AND WATER CONSERVATION ACTIVITIES 64](#_Toc9411736)

[TRACTORS AND POWER UNITS 67](#_Toc9411737)

[IRRIGATION ACTIVITES 69](#_Toc9411738)

[RENEWABLE ENERGY TECHNOLOGY IN AGRICULTURE 72](#_Toc9411739)

[REFRIGERATION AND AIR CONDITIONING SYSTEMS 75](#_Toc9411740)

[MANAGEMENT OF AGRICULTURAL ENGINEERING AND RELATED PROJECT 78](#_Toc9411741)

[OPERATION OF AGRICULTURAL HARVESTING MACHINERY AND EQUIPMENT 81](#_Toc9411742)

ABBREVIATIONS AND ACRONYMNS

A Control version

AGR Agriculture

AIDS Acquired Immunodeficiency Syndrome

BC Basic Unit

CBET Competency Based Education and Training

CC Common unit

CDACC Curriculum Development Assessment Certification Council

CEO Council Secretary

CR Core Unit

CU Curriculum

EHS Environment, Health and Safety

ENG Engineering

HIVHuman Immuno-Deficiency Virus

IBMS Integrated Building Management System

KCSE Kenya Certificate of Secondary Education

KEBS Kenya Bureau of Standards

KNQA Kenya National Qualifications Authority

LCD Liquid Crystal Display

NCA National Construction Authority

NIST National institute of Standards and Technology

OSH Occupational Safety and Health

OSHA Occupational Safety and Health Act

OWAS Open web application security

PESTEL Political Environmental Social Technological Economic Legal

PPE Personal Protective Equipment

Q&A Questions and Answer

SSAC Sector Skills Advisory Committee

SWOT Strength Weakness Opportunity Threat

TVET Technical and Vocational Education and Training

WIBA Work injury benefits Act

**KEY TO UNIT CODE**

**ENG/CU/AGR/BC/01/6/A**

Industry or sector

Curriculum

Occupational area

Type of competency

Competency number

Competency level

Control Version

# COURSE OVERVIEW

Agircultural Engineering Level 6 qualification consists of competencies that a person must achieve to enable him/her to operate agricultural and related production machinery, construct farmstead structures and farm roads, perform produce post-harvest activities, perform soil and water conservation activities, demonstrate understanding of tractors and power units, perform irrigation activities, apply renewable energy in agriculture, install refrigeration and air conditioning system, manage an agricultural project and operate agricultural harvesting machinery and equipment.

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/AGR/BC/01/6/A | Communication Skills | 40 | 4.0 |
| ENG/CU/AGR/BC/02/6/A | Digital Literacy | 60 | 6.0 |
| ENG/CU/AGR/BC/03/6/A | Entrepreneurial Skills | 100 | 10.0 |
| ENG/CU/AGR/BC/04/6/A | Employability Skills | 80 | 8.0 |
| ENG/CU/AGR/BC/05/6/A | Environmental Literacy | 40 | 4.0 |
| ENG/CU/AGR/BC/06/6/A | Occupational Safety and Health Practices | 40 | 4.0 |
| **Subtotal 1** | | **360** | **36**.0 |

**Common Units of Learning**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Duration in Hours** | **Credit Factors** |
| ENG/CU/AGR/CC/01/6/A | Engineering Mathematics | 60 | 6.0 |
| ENG/CU/AGR/CC/02/6/A | Principles of Mechanical Science | 60 | 6.0 |
| ENG/CU/AGR/CC/03/6/A | Fluid Mechanics | 60 | 6.0 |
| ENG/CU/AGR/CC/04/6/A | Thermodynamics | 60 | 6.0 |
| ENG/CU/AGR/CC/05/6/A | Material Science and Metallurgical Process | 60 | 6.0 |
| ENG/CU/AGR/CC/06/6/A | Electrical Principles | 60 | 6.0 |
| ENG/CU/AGR/CC/07/6/A | Workshop Technology Practices | 60 | 6.0 |
| **Subtotal 2** | | **420** | **42**.0 |

**Core Units of Learning**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Duration in Hours** | **Credit Factors** |
| ENG/CU/AGR/CR/01/6/A | Operation of Agricultural and Related Production Machinery and Equipment | 120 | 12.0 |
| ENG/CU/AGR/CR/02/6/A | Construction of Farmstead Structures and Farm Roads | 190 | 19.0 |
| ENG/CU/AGR/CR/03/6/A | Produce Post-Harvest Activities | 130 | 13.0 |
| ENG/CU/AGR/CR/04/6/A | Soil and Water Conservation Activities | 120 | 12.0 |
| ENG/CU/AGR/CR/05/6/A | Tractors and Power Units | 130 | 13.0 |
| ENG/CU/AGR/CR/06/6/A | Irrigation Activities | 110 | 11.0 |
| ENG/CU/AGR/CR/07/6/A | Renewable Energy Technology in Agriculture | 70 | 7.0 |
| ENG/CU/AGR/CR/08/6/A | Refrigeration and Air Conditioning System | 130 | 13.0 |
| ENG/CU/AGR/CR/09/6/A | Management of Agricultural Projects | 120 | 12.0 |
| ENG/CU/AGR/CR/10/6/A | Operation of Agricultural Harvesting Machinery and Equipment | 110 | 11.0 |
| ENG/CU/AGR/CR/12/6/A | Industrial Attachment | 480 | 48.0 |
| **Subtotal 3** | | 1,710 | 171.0 |
| **Grand Total** | | **2,610** | **261**.**0** |

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

The total duration of the **course is 2,610 hours** (87 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.) with a minimum mean grade of C- (C minus)

**Or**

1. Level 5 certificate in a related course

**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 an Agricultural Engineering firm for a period of at least 480 hours. Attachment will be undertaken upon completion of the course or the unit of learning.

**Trainer qualification**

Trainer of this course must have a qualification higher than this course

**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 Agricultural Engineering Level 6, 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/AGR/BC/01/6/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate Communication Skills

**Duration of Unit:** 40 hours

**Unit Description**

This unit covers the competencies required to demonstrate communication skills .It involves, meeting communication needs of clients and colleagues; developing communication strategies, establishing and maintaining communication pathways, conducting interviews, facilitating group discussion and representing the organization.

**Summary of Learning Outcomes**

1. Meet communication needs of clients and colleagues
2. Develop communication strategies
3. Establish and maintain communication pathways
4. Promote use of communication strategies
5. Conduct interview
6. Facilitate group discussion
7. Represent the organization

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Meet communication needs of clients and colleagues | * 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 * Types of communication strategies * Elements of communication strategy | * Interview * Written texts |
| 1. Develop communication strategies | * Dynamics of groups * Styles of group leadership * Openness and flexibility in communication * Communication skills relevant to client groups | * Interview * Written texts |
| 1. Establish and maintain communication pathways | * Types of communication pathways | * Interview * Written texts |
| 1. Promote use of communication strategies | * Application of elements of communication strategies * Effective communication techniques | * Interview * Written texts |
| 1. Conduct interview | * Types of interview * Establishing rapport * Facilitating resolution of issues * Developing action plans | * Interview * Written texts |
| 1. Facilitate group discussion | * Identification of communication needs * Dynamics of groups * Styles of group leadership * Presentation of information * Encouraging group members participation * Evaluating group communication strategies | * Interview * Written texts |
| 1. Represent the organization | * Presentation techniques * Development of a presentation * Multi-media utilization in presentation * Communication skills relevant to client groups | * Interview * Written texts |

**Suggested Methods of Instruction**

* Discussion
* Role playing
* Simulation
* Direct instruction

**Recommended Resources**

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

# DIGITAL LITERACY

**UNIT CODE:** .ENG/CU/AGR/BC/02/6/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate Digital Literacy

**Duration of Unit:** 60 hours

**Unit Description**

This unit describes competencies required to demonstrate digital literacy. It involves in identifying computer software and hardware, applying security measures to data, hardware, software in automated environment, computer software in solving task, internet and email in communication at workplace, desktop publishing in official assignments and preparing presentation packages.

**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 |
| 1. Apply security measures to data, hardware, software in automated environment | * 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 * 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 * Project |
| 1. Apply internet and email in communication at workplace | * Computer networks * Network configurations * Uses of internet * Electronic mail (e-mail) concept | * Oral questioning * 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 * 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 * Written report * Project |

**Suggested Methods of Instruction**

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

**Recommended Resources**

* Computers
* Printers
* Storage devices
* Internet access

# ENTREPRENEURIAL SKILLS

**UNIT CODE:** ENG/CU/AGR/BC/03/6/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate Entrepreneurial Skills

**Duration of unit:** 100 hours

**Unit Description**

This unit covers the competencies required to demonstrate understanding of entrepreneurship. It involves demonstrating understanding of an entrepreneur, entrepreneurship and self-employment. It also involves identifying entrepreneurship opportunities, creating entrepreneurial awareness, applying entrepreneurial motivation and developing business innovative strategies.

**Summary of Learning Outcomes**

* 1. Demonstrate understanding of who an entrepreneur
  2. Demonstrate knowledge of entrepreneurship and self-employment
  3. Identify entrepreneurship opportunities
  4. Create entrepreneurial awareness
  5. Apply entrepreneurial motivation
  6. Develop business innovative strategies
  7. Develop Business plan

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Demonstrate knowledge of entrepreneurship and self-employment | * Importance of self-employment * Requirements for entry into self-employment * Role of an Entrepreneur in business * Contributions of Entrepreneurs to National development * Entrepreneurship culture in Kenya * Born or made entrepreneurs | * Individual/group assignments * Projects * Written tests * Oral questions * Third party report |
| 1. Identify entrepreneurship opportunities | * Business ideas and opportunities * Sources of business ideas * Business life cycle * Legal aspects of business * Assessment of product demand * Business environment * Factors to consider when evaluating business environment * Technology in business | * Individual/group assignments * Projects * Written tests * Oral questions * Third party report * Interviews |
| 1. Create entrepreneurial awareness | * Forms of businesses * Sources of business finance * Factors in selecting source of business finance * Governing policies on Small Scale Enterprises (SSEs) * Problems of starting and operating SSEs | * Individual/group assignments * Projects * Written tests * Oral questions * Third party report * Interviews |
| 1. Apply entrepreneurial motivation | * Internal and external motivation * Motivational theories * Self-assessment * Entrepreneurial orientation * Effective communications in entrepreneurship * Principles of communication * Entrepreneurial motivation | * Case studies * Individual/group assignments * Projects * Written tests * Oral questions * Third party report * Interviews |
| 1. Develop business innovative strategies | * Innovation in business * Small business Strategic Plan * Creativity in business development * Linkages with other entrepreneurs * ICT in business growth and development | * Case studies * Individual/group assignments * Projects * Written tests * Oral questions * Third party report * Interviews |
| 6. Develop Business Plan | * Business description * Marketing plan * Organizational/Management * plan * Production/operation plan * Financial plan * Executive summary * Presentation of Business Plan | * Case studies * Individual/group assignments * Projects * Written tests * Oral questions * Third party report * Interviews |

**Suggested Methods of Instruction**

* Direct instruction
* Project
* Case studies
* Field trips
* Discussions
* Demonstration
* Question and answer
* Problem solving
* Experiential
* Team training

**Recommended Resources**

* Case studies
* Business plan templates
* Computers
* Overhead projectors
* Internet
* Mobile phone
* Video clips
* Films
* Newspapers and Handouts
* Business Journals
* Writing materials

# EMPLOYABILITY SKILLS

**UNIT CODE:** ENG/CU/AGR/BC/04/6/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate Employability Skills

**Duration of Unit:** 80 hours

**Unit Description**

This unit covers competencies required to demonstrate employability skills. It involves conducting self-management, demonstrating interpersonal communication, critical safe work habits, leading a workplace team, planning and organizing work, maintaining professional growth and development, demonstrating workplace learning, problem solving skills and managing ethical performance.

**Summary of Learning Outcomes**

1. Conduct self-management
2. Demonstrate interpersonal communication
3. Demonstrate critical safe work habits
4. Lead a workplace team
5. Plan and organize work
6. Maintain professional growth and development
7. Demonstrate workplace learning
8. Demonstrate problem solving skills
9. Manage ethical performance

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Conduct self-management | * Self-awareness * Formulating personal vision, mission and goals * Strategies for overcoming life challenges * Managing emotions * Emotional intelligence * Assertiveness versus aggressiveness * Expressing personal thoughts, feelings and beliefs * Developing and maintaining high self-esteem * Developing and maintaining positive self-image * Setting performance targets * Monitoring and evaluating performance * Articulating ideas and aspirations * Accountability and responsibility * Good work habits * Self-awareness * Values and beliefs * Self-development * Financial literacy * Healthy lifestyle practices * Adopting safety practices | * Written tests * Oral questioning * Interviewing * Portfolio of evidence * Third party report |
| 1. Demonstrate interpersonal communication | * Meaning of interpersonal communication * Listening skills * Types of audience * Public speaking * Writing skills * Negotiation skills * Reading skills * Meaning of empathy * Understanding customers’ needs * Establishing communication networks * Assertiveness * Sharing information | * Written tests * Oral questioning * Interviewing * Portfolio of evidence * Third party report |
| 1. Demonstrate critical safe work habits | * 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 * Managing emerging issues | * Written tests * Oral questioning * Interviewing * Portfolio of evidence * Third party report |
| 1. Lead a workplace team | * Leadership qualities * Power and authority * Team building * Determination of team roles and objectives * Team parameters and relationships * Individual responsibilities in a team * Forms of communication * Complementing team activities * Gender and gender mainstreaming * Human rights * Developing healthy relationships * Maintaining relationships * Conflicts and conflict resolution * Coaching and mentoring skills | * Written tests * Oral questioning * Interviewing * Portfolio of evidence * Third party report |
| 1. Plan and organize work | * Functions of management * Planning * Organizing * Time management * Decision making concept * Task allocation * Developing work plans * Developing work goals/objectives and deliverables * Monitoring work activities * Evaluating work activities * Resource mobilization * Resource allocation * Resource utilization * Proactive planning * Risk evaluation * Problem solving * Collecting, analysing and organising information * Negotiation | * Written tests * Oral questioning * Interviewing * Portfolio of evidence * Third party report |
| 1. Maintain professional growth and development | * 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 | * Written tests * Oral questioning * Interviewing * Portfolio of evidence * Third party report |
| 1. Demonstrate workplace learning | * Managing own learning * Mentoring * Coaching * Contributing to the learning community at the workplace * Cultural aspects of work * Networking * Variety of learning context * Application of learning * Safe use of technology * Taking initiative/proactivity * Flexibility * Identifying opportunities * Generating new ideas * Workplace innovation * Performance improvement * Managing emerging issues * Future trends and concerns in learning | * Written tests * Oral questioning * Interviewing * Portfolio of evidence * Third party report |
| 1. Demonstrate problem solving skills | * Critical thinking process * Data analysis tools * Decision making * Creative thinking * Development of creative, innovative and practical solutions * Independence in identifying and solving problems * Solving problems in teams * Application of problem-solving strategies * Testing assumptions * Resolving customer concerns | * Written tests * Oral questioning * Interviewing * Portfolio of evidence * Third party report |
| 1. Manage ethical performance | * Meaning of ethics * Ethical perspectives * Principles of ethics * Ethical standards * Organization code of ethics * Common ethical dilemmas * Organization culture * Corruption, bribery and conflict of interest * Privacy and data protection * Diversity, harassment and mutual respect * Financial responsibility/accountability * Etiquette * Personal and professional integrity * Commitment to jurisdictional laws * Emerging issues in ethics | * Written tests * Oral questioning * Interviewing * Portfolio of evidence * Third party report |

**Suggested Methods of Instruction**

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

**Recommended Resources**

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

# ENVIRONMENTAL LITERACY

**UNIT CODE**:ENG./CU/AGR/BC/05/6/A

**Relationship to Occupational Standards**:

This unit addresses the Unit of Competency: Demonstrate Environmental Literacy

**Duration of Unit:** 40 hours

**Unit Description**

This unit describes the competencies required demonstrate environmental literacy.it involves controlling environmental hazard, controlling environmental pollution, complying with workplace sustainable resource use, evaluating current practices in relation to resource usage, identifying environmental legislations/conventions for environmental concerns, implementing specific environmental programs, monitoring activities on environmental protection/programs, analysing resource use and developing resource conservation plans.

**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
8. Analyze resource use
9. Develop resource conservation plans

**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 * 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 |
| 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 * 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 * 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 * 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 |
| 1. Implement specific environmental programs | * Community needs and expectations * Resource availability * 5s of good housekeeping * Identification of programs/Activities * Setting of individual roles /responsibilities * Resolving problems /constraints encountered * Consultation with stakeholders | * Written questions * Oral questions * Role play |
| 1. Monitor activities on Environmental protection/Programs | * Periodic monitoring and Evaluation of activities * Gathering feedback from stakeholders * Analyzing 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 |
| 1. Analyze resource use | * Identification of resource consuming processes * Determination of quantity and nature of resource consumed * Analysis of resource flow through different parts of the process. * Classification of wastes for possible source of resources. | * Written tests * Oral questions * Practical test |
| 1. Develop resource Conservation plans | * Determination of efficiency of use/conversion of resources * Causes of low efficiency of use of resources * Plans for increasing the efficiency of resource use | * Written tests * Oral questions * Practical test |

**Suggested Methods of Instruction**

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

**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/AGR/BC/06/6/A

**Relationship to Occupational Standards**

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

**Duration of Unit:** 40 hours

**Unit Description**

This unit specifies the competencies required to demonstrate occupational health and safety practices. It involves identifying workplace hazards and risk, identifying and implementing appropriate control measures to hazards and risks and implementing OSH programs, procedures and policies/guidelines.

**Summary of Learning Outcomes**

1. Identify workplace hazards and risk
2. Control OSH hazards
3. Implement OSH programs

**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 * Gathering of OSH issues and/or concerns | * Oral questions * Written tests * Portfolio of evidence * Third party report |
| 1. Control OSH hazards | * Prevention and control measures e.g. use of PPE * Risk assessment * Contingency measures | * Oral questions * Written tests * Portfolio of evidence * Third party report |
| 1. Implement OSH   programs | * Company OSH program, evaluation and review * Implementation of OSH programs * Training of team members and advice on OSH standards and procedures * Implementation of procedures for maintaining OSH-related records | * Oral questions * Written tests * Portfolio of evidence * Third party report |

**Suggested Methods of Instruction**

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

**Recommended Resources**

* 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

# ENGINEERING MATHEMATICS

**UNIT CODE:** ENG/CU/AGR/CC/01/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Apply Engineering Mathematics

**Duration of Unit:** 110 hours

**Unit Description**

This unit describes the competencies required by an agricultural technician to apply a wide range of engineering mathematics in their work. this includes applying algebraic functions, trigonometry and hyperbolic functions, complex numbers, coordinate geometry, carrying out binomial expansion, applying calculus, solving ordinary differential equations, applying Laplace transforms, power series, statistics, Fourier series, vector theory, matrix, numerical methods, concept of probability for work, commercial calculations and performing estimations, measurements and calculations of quantities in solving problems

**Summary of Learning Outcomes**

1. Apply Algebra
2. Apply Trigonometry and hyperbolic functions
3. Apply complex numbers
4. Apply Coordinate Geometry
5. Carry out Binomial Expansion
6. Apply Calculus
7. Solve Ordinary differential equations
8. Apply Laplace transforms
9. Apply Power Series
10. Apply Statistics
11. Apply Fourier Series
12. Apply Vector theory
13. Apply Matrix
14. Apply Numerical methods
15. Apply concept of probability for work
16. Perform commercial calculations
17. Perform Estimations, Measurements and calculations of quantities

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

|  |  |  |
| --- | --- | --- |
| **Electrical Curriculum** | | |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| * 1. Apply Algebra | * Base and Index * Law of indices * Indicial equations * Laws of logarithm * Logarithmic equations * Conversion of bases * Use of calculator * Reduction of equations * Solution of equations reduced to quadratic form * Solutions of simultaneous linear equations in three unknowns * Solutions of problems involving AP and GP | * Written tests * Oral questioning * Assignments * Supervised exercises |
| * 1. Apply Trigonometry and hyperbolic functions | * Half -angle formula * Factor formula * Trigonometric functions * Parametric equations * Relative and absolute measures * Measures calculation * Meaning of hyperbolic equations * Properties of hyperbolic functions * Evaluations of hyperbolic functions Hyperbolic identities * Osborne’s Rule * Ashx+bshx=C equation * One-to-one relationship in functions * Inverse functions for one-to-one relationship * Inverse functions for trigonometric functions * Graph of inverse functions * Inverse hyperbolic functions | * Written tests * Oral questioning * Assignments * Supervised exercises |
| * 1. Apply complex numbers | * Meaning of complex numbers * Stating complex numbers in numbers in terms of conjugate argument and * Modulus * Representation of complex numbers on the Argand diagram * Arithmetic operation of complex numbers Application of De Moivre’s theorem * Application of complex numbers to engineering | * Assignments * Oral questioning * Supervised exercises * Written tests |
| * 1. Apply Coordinate Geometry | * Polar equations * Cartesian equation * Graphs of polar equations * Normal and tangents * Definition of a point * Locus of a point in relation to a circle * Loci of points for given mechanism | * Written tests * Oral questioning * Assignments * Supervised exercises |
| * 1. Carry out Binomial Expansion | * Binomial theorem Power series using binomial theorem Roots of numbers using binomial theorem. * Estimation of errors of small changes using binomial theorem. | * Written tests * Oral questioning * Assignments * Supervised exercises |
| * 1. Apply Calculus | * Meaning of derivatives of a function * Differentiation from fist principle * Tables of some common derivatives * Rules of differentiation * Rate of change and small change * Stationery points of functions of two variables * Meaning of integration * Indefinite and definite integral * Methods of integration application of integration. * Integrals of hyperbolic and inverse functions | * Written tests * Oral questioning * Assignments * Supervised exercises |
| * Solve Ordinary differential equations | * Types of first order differential equations * Formation of first order differential equation * Solution of first order differential equations * Application of first order differential equations * Formation of second order differential equations for various systems * Solution of second order differential equations * Application of second order differential equations | * Written tests * Oral questioning * Assignments * Supervised exercises |
| * 1. Apply Laplace transforms | * Meaning of Laplace transforms * Deriving Laplace transforms from first principles * State properties of Laplace transform * Determination of inverse LT of simple transforms and partial fractions * Solution of differential equation by LT * Solution of simultaneous differential equation by given initial conditions | * Written tests * Oral questioning * Assignments * Supervised exercises |
| * 1. Apply Power Series | * Meaning of the term power series * Taylor’s theorem * Deduction of Maclaurin’s theorem to obtain power series * Application of Taylor’s theorem and Maclaurin’s theorems in numerical work | * Written tests * Oral questioning * Assignments * Supervised exercises |
| * 1. Apply Statistics | * Classification of data * Grouped data * Ungrouped data * Data collection * Tabulation of data   + Class intervals   + Class boundaries   + Frequency tables * Diagrammatic and graphical presentation of data e.g.   + Histograms   + Frequency polygons   + Bar charts   + Pie charts   + Cumulative frequency curves * Measures of central tendency mean, mode and median * Measures of dispersion * Variance and standard deviation * Definition of probability * Laws of probability * Expectation variance and S.D. * Types of distributions * Mean, variance and SD of probability distributions * Application of probability distributions | * Assignments * Oral questioning * Supervised exercises * Written tests * Simulation * Data modelling |
| * 1. Apply Fourier Series | * Determination of the Fourier series as a periodic function of the period 2π and extend to π * Determination of Fourier series of non-periodic functions over a given range * Determination of Fourier series for even and odd functions and the half-range series for a given function | * Assignments * Oral questioning * Supervised exercises * Written tests |
| * 1. Apply Vector theory | * Definition of dot and cross product of vectors * Solution of problems involving dot and cross production of cross * Definition of operators * Definition of vector field * Solutions of problems involving vector fields * Definition of Gradient, Divergence and curl * Solutions of involving Gradient, Divergence and curl * Application of vectors | * Assignments * Oral questioning * Supervised exercises * Written tests |
| * Apply Matrix methods | * Matrix operation * Determinant of 3x3 matrix * Inverse of 3x3 matrix * Solutions of linear simultaneous equations in three unknowns * Application of matrices | * Assignments * Oral questioning * Supervised exercises * Written tests |
| * 1. Apply Numerical methods | * Meaning of interpolation and extrapolation * Application of interpolation * Application of interactive methods to solve equations * Application of interactive methods to areas and volumes | * Assignments * Oral questioning * Supervised exercises * Written tests |
| 1. Apply concepts of probability in work | * + Meaning of probability   + Types of probability events * Dependent * Independent * Mutually exclusive   + Laws of probability   + Counting techniques * Permutation * Combination * Tree diagrams * Venn diagrams | * Assignments * Oral questioning * Supervised exercises * Written tests |
| 1. Perform commercial calculations | * + Product pricing   + Average sales determination   + Stock turnover   + Calculation of incomes   + Profit and loss calculations   + Salaries * Gross * Net   + Wages * Time rate * Flat rate * Overtime * Piece rate * Commission * Percentage * Bonus   + Conversion of one currency to another   + Exchange rates calculation * Devaluation * Revaluation | * Oral questioning * Written tests * Assignments * Supervised exercises |
| 1. Perform estimations, measurements and calculations of quantities | * Units of measurements and their symbols * Conversion of units of measurement * Calculation of length, width, height, perimeter, area and angles of figures * Measuring tools and equipment * Performing measurements and estimations of quantities | * Assignments * Oral questioning * Practical tests * Observation * Supervised exercises * Written tests |

**Suggested Methods of Instruction**

* Group discussions
* Demonstration by trainer
* Exercises by trainee

**Recommended Resources**

* Scientific Calculators
* Rulers, pencils, erasers
* Charts with presentations of data
* Graph books
* Dice
* Computers with internet connection

# WORKSHOP PROCESSES AND MATERIAL

**UNIT CODE:** ENG/CU/AGR/CC/02/6/A

**Relationship to Occupational Standards:**

This unit addresses the unit of competency: Perform Workshop Processes and Material

Duration of Unit: 240 Hours

**Unit description**

This unit covers the competencies required by an Agricultural technician to perform workshop processes and materials. It involves demonstrating understanding of workshop processes, workshop machines, workshop materials, fabricating farm tools and equipment, preparing and documenting workshop activities and reports and maintaining farm machinery and workshop tools and equipment

**Summary of Learning Outcome**

1. Demonstrate understanding of workshop procedures
2. Demonstrate understanding of workshop machines
3. Demonstrate understanding of workshop materials
4. Fabricate farm tools and equipment
5. Prepare and document workshop activities reports
6. Maintain farm machinery and workshop tools and equipment

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

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Demonstrate understanding of workshop procedures | * Meaning of terms * Types of workshop * Workshop rules, procedures and regulations * Purposes of workshop in various engineering operations * Workshop tools, equipment and materials * Types * Function * Classification * Application | * Assignments * Oral questioning * Practical tests * Observation * Supervised exercises * Written tests |
| 1. Demonstrate understanding of workshop machines | * Meaning of terms * Various types of workshop machines * Functions and operation of workshop machines * Maintenance of workshop machines | * Assignments * Oral questioning * Practical tests * Observation * Supervised exercises * Written tests |
| 1. Demonstrate understanding of workshop materials | * Workshop materials * Types of workshop materials * Classification of workshop materials * Properties and application of workshop materials * Storage of various types of workshop materials * Preparation of workshop materials * Safety precautions in workshop material handling | * Assignments * Oral questioning * Practical tests * Observation * Supervised exercises * Written tests |
| 1. Fabricate farm tools and equipment | * Meaning of terms * Types of farm equipment to be fabricated * Design of farm equipment before workshop fabrication process * Fabricating tools, equipment and machines * Fabrication process and testing | * Assignments * Oral questioning * Practical tests * Observation * Supervised exercises * Written tests |
| 1. Prepare and document workshop activities reports | * Types of reports * Report preparation and dissemination * Filing of workshop report | * Assignments * Oral questioning * Practical tests * Observation * Supervised exercises * Written tests |
| 1. Maintain farm machinery and workshop tools and equipment | * Meaning of terms * Types of farm maintenance and their application * Factors to be considered in maintenance of farm machinery and equipment * Manufacturers manuals in maintenance of farm machinery * Workshop rules and procedures in maintenance of farm machinery and equipment | * Assignments * Oral questioning * Practical tests * Observation * Supervised exercises * Written tests |

**Suggested Methods of Instruction**

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

**List of Recommended Resources**

* 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/AGR/CC/03/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Apply Principles of Mechanical Science

**Duration of Unit:** 160 hours

**Unit Description**

This unit describes the competencies required by a technician in order to apply a wide range of principles of mechanical science in their work. It involves determining forces in a system, demonstrating knowledge of moments, friction principles, motion, friction principles, motions in engineering, describing work, energy and power, performing machine calculations, demonstrating understanding of gas principles, applying heat knowledge, density knowledge and pressure principles

**Summary of Learning Outcomes**

1. Determine forces in a system
2. Demonstrate the knowledge of moments
3. Demonstrate understanding of friction principles
4. Demonstrate understand of motions in engineering
5. Describe work, energy and power
6. Perform machine calculations
7. Demonstrate understanding of gas principles
8. Apply heat knowledge
9. Apply density knowledge
10. Apply pressure principles

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| * + 1. Determine forces in a system | * Meaning of terms * Types of forces * Discussion and analysis of various types of forces * Conversion and SI units of various parameters * Force * Work * Mechanical advantage * Efficiency * Energy * Force theorem * Determination of resultant of coplanar forces * Application of different types of forces | * Written tests * Oral questioning * Assignments * Supervised exercises |
| * + 1. Demonstrate the knowledge of moments | * Meaning of terms * Meaning and calculation of moment * Principles of moment * Identification and application of couples | * Written tests * Oral questioning * Assignments * Supervised exercises |
| * + 1. Demonstrate understanding of friction principles | * Meaning of terms * Laws of friction * Calculation of limiting friction * Calculations of coefficients of friction * Advantage and disadvantages of friction. | * Assignments * Oral questioning * Supervised exercises * Written tests |
| * + 1. Demonstrate understanding of motions in engineering | * Meaning of terms * Motion concept * Laws of motion * Calculation of motion | * Assignments * Oral questioning * Practical tests * Observation * Supervised exercises * Written tests |
| * + 1. Describe work, energy and power | * + Meaning of terms * Work * Energy * Power * Calculation of work, energy and power | * Assignments * Supervised exercises * Written tests * Practical test |
| * + 1. Perform machine calculations | * + Meaning of terms   + Laws of machines   + Solutions on problems involving simple machines   + Solution of problems on levers | * Assignments * Supervised exercises * Written tests * Practical test |
| * + 1. Demonstrate understanding of gas principles | * + Meaning of terms   + Gas Laws   + Importance of gas laws in engineering   + Application of gas laws in engineering | * Assignments * Supervised exercises * Written tests * Practical test |
| * + 1. Apply heat knowledge | * + Meaning of terms   + Heat concept   + Working principles of heat   + Heat capacity   + Solution of problems on heat | * Assignments * Supervised exercises * Written tests * Practical test |
| * + 1. Apply density knowledge | * + Meaning of terms   + Measurements of density   + Solutions on density problems | * Assignments * Supervised exercises * Written tests * Practical test |
| * + 1. Apply pressure principles | * + Meaning of terms   + Discussions on pressure concept   + Working principles of pressure   + Solutions of pressure problems   + Application of pressure | * Assignments * Supervised exercises * Written tests * Practical test |

**Suggested Methods of Instruction**

* 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

# FLUID MECHANICS

**UNIT CODE:** ENG/CU/AGR/CC/04/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Apply Principles of Fluid Mechanics

**UNIT DESCRIPTION**

This unit describes the competencies required by a technician in order to apply a wide range of principles of fluid mechanics in their work. It involves demonstrating understanding of flow in fluids, demonstrating knowledge in viscous flow, performing dimensional analysis and operating fluid pumps.

**Summary of Learning Outcomes**

1. Demonstrate understanding of flow in fluids
2. Demonstrate knowledge in viscous flow
3. Perform dimensional analysis
4. Operate fluid pumps

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Demonstrate understanding of flow in fluids | * Meaning of terms * Flow rate in pipes * Losses in pipes are determined * Causes of losses in pipes * Flow losses equations | * Written tests * Oral questioning * Assignments * Supervised exercises |
| 1. Demonstrate knowledge in viscous flow | * Meaning of terms * Viscous flow between parallel surfaces * Viscous flow equations between parallel surfaces * Viscous flow equations in circular pipes * Application of viscous flow equations | * Written tests * Oral questioning * Assignments * Supervised exercises |
| 1. Perform dimensional analysis | * Meaning of terms * Dimensional analysis definition * Principle of dimensional homogeneity * Fundamental dimensions * Dimensional units * Physical quantities * Application of dimensional analysis | * Assignments * Oral questioning * Supervised exercises * Written tests |
| 1. Operate fluid pumps | * Principle of operation of pumps * Deriving Reciprocating pump equation * Deriving Centrifugal pump equation * Application of Pump equation in problem solving | * Assignments * Oral questioning * Practical tests * Observation * Supervised exercises * Written tests |

**Suggested Methods of Instruction**

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

**Recommended Resources**

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

# THERMODYNAMICS

**UNIT CODE:** ENG/CU/AGR/CC/05/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Apply Thermodynamics Principles

**UNIT DESCRIPTION**

This unit describes the competencies required by a technician in order to apply thermodynamics principles in their work. It involves understanding fundamentals of thermodynamics, performing steady flow processes, performing non-steady flow processes, understanding perfect gases, generating steam, performing thermodynamics reversibility and entropy, understanding idea gas cycle, demonstrating understanding of fuel and combustion, performing heat transfer, understanding heat exchangers, air compressors, gas turbines and impulse steam turbines.

**Summary of Learning Outcomes**

1. Understand fundamentals of thermodynamics
2. Perform steady flow processes
3. Perform non steady flow processes
4. Understand perfect gases
5. Generate steam
6. Perform thermodynamics reversibility and entropy
7. Understand idea gas cycle
8. Demonstrate understanding fuel and combustion
9. Perform heat transfer
10. Understand heat exchangers
11. Understand air compressors
12. Understand gas turbines
13. Understanding impulse steam turbines

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Understand fundamentals of thermodynamics | * Terms used in thermodynamics * Thermodynamics processes and cycles * First law of thermodynamics | * Written tests * Oral questioning * Assignments * Supervised exercises |
| 1. Perform steady flow processes | * Deriving Steady flow energy equation * Applying Steady flow energy equation * Application of Steady flow energy equation in utilities | * Written tests * Oral questioning * Assignments * Supervised exercises |
| 1. Perform non steady flow processes | * Deriving non-flow energy equation * Application of Non-flow energy equation in problem solving | * Assignments * Oral questioning * Supervised exercises * Written tests |
| 1. Understand perfect gases | * State Perfect gas laws * Carrying out Gas laws experiment * Application of Gas laws | * Assignments * Oral questioning * Supervised exercises * Written tests |
| 1. Generate steam | * Determining Dryness fraction * Determining Relationship between pressure and boiling point * Carrying out Energy balance * Determining Relationship between temperature and pressure | * Assignments * Oral questioning * Practical tests * Observation * Supervised exercises |
| 1. Perform thermodynamics reversibility and entropy | * Thermodynamics reversibility principles * Principles of heat engine * Second law of thermodynamics * Entropy in thermodynamics | * Assignments * Oral questioning * Observation * Supervised exercises |
| 1. Understand idea gas cycle | * Ideal gas cycle processes * Air standard efficiency and actual efficiency are differentiated * Problems are solved in ideal gas cycle | * Assignments * Oral questioning |
| 1. Demonstrate understanding of fuel and combustion | * Classification of fuels * Properties of fuels * Deriving of Combustion equation * Application of Combustion equation | * Oral questioning * Practical tests * Observation * Supervised exercises |
| 1. Perform heat transfer | * Deriving Conduction equation from Fourier’s law * Heat transfer equation is derived and applied from Newton’s law of cooling and Fourier’s law | * Assignments * Oral questioning |
| 1. Understand heat exchangers | * Classification of Heat exchangers * Recuperative heat exchangers are described * Application of Heat equations | * Assignments * Oral questioning * Practical tests * Observation * Supervised exercises |
| 1. Understand air compressors | * Classification of Air compressors * Types of air compressors * Deriving and applying Equations of reciprocating compressors | * Assignments * Oral questioning * Practical tests * Observation * Supervised exercises |
| 1. Understand gas turbines | * Theoretical cycle for gas turbines * Open cycle gas turbine * Closed cycle gas turbine * Deriving Gas turbine equations | * Assignments * Oral questioning * Practical tests * Observation * Supervised exercises |
| 1. Understanding impulse steam turbines | * Principles of operations of the impulse steam turbines * Deriving and applying Impulse steam turbine equation | * Assignments * Oral questioning * Practical tests * Observation * Supervised exercises |

**Suggested Methods instruction**

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

**Recommended Resources**

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

# MATERIAL SCIENCE AND METALLURGICAL PROCESSES

**UNIT CODE:** ENG/CU/AGR/CC/06/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Apply Material Science and Perform Metallurgical Processes

**Unit Description:**

This units specifies competencies required to apply material science and perform metallurgical processes.it involves analysing properties of engineering materials, performing ore extraction processes, producing iron, alloys, non-ferous, ceramics and composite materials , utilising other engineering materials, performing heat treatment, material testing and preventing material corrosion.

**Summary of Learning Outcomes**

1. Analyse properties of engineering materials
2. Perform ore extraction processes
3. Produce iron materials
4. Produce alloy materials
5. Produce non-ferrous materials
6. Produce ceramics materials
7. Produce composite materials
8. Utilise other engineering materials
9. Perform heat treatment
10. Perform material testing
11. Prevent material corrosion

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Analyse properties of engineering materials | * Engineering materials is 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 iron materials | * Ore smelting processes. * Composition of iron * Method of producing iron material * Refinement processes | * Assignments * Oral questioning * Supervised exercises * Written tests |
| 1. Produce alloy materials | * Tools and equipment for alloy production * Alloy formation process * Testing alloy products quality | * Assignments * Oral questioning * Practical tests * Observation * Supervised exercises * Written tests |
| 1. Produce non-ferrous materials | * + Extraction of Non-ferrous materials   + Smelting and purifying of extracted non-ferrous material   + Testing Non-ferrous material   + Identifying Alloying elements for non-ferrous materials   + Alloy formation process   + Testing of Alloys for non-ferrous material | * Assignments * Supervised exercises * Written tests * Practical test |
| 1. Produce ceramics materials | * + Composition of ceramic materials   + Manufacturing process for ceramics   + Production of Ceramic materials   + Finishing processes for ceramic materials | * Assignments * Supervised exercises * Written tests * Practical test |
| 1. Produce composite materials | * + Types of composites   + Elements involve in composite formation   + Formation process of composites   + Testing of composite materials | * Assignments * Supervised exercises * Written tests * Practical test |
| 1. Utilise other engineering materials | * + Identifying and selecting engineering materials   + Developing operation plan   + Setting up production machine   + Setting production parameters   + Production process for engineering materials | * Assignments * Supervised exercises * Written tests * Practical test |
| 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. Perform material testing | * + **Material testing methods**   + Procedure of material testing   + Analysing Material testing results   + Material testing equipment are taken care of and maintained. | * Assignments * Supervised exercises * Written tests * Practical test |
| 1. Prevent material corrosion | * + Safety observation during corrosion prevention * Corrosion type is identified * Causes of corrosion * Methods of corrosion prevention * Corrosion prevention | * Assignments * Supervised exercises * Written tests * Practical test |

**Suggested Methods of Instruction**

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

**Recommended Resources**

* 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/AGR/CC/07/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Apply Electrical Principles

**Duration of Unit:** 240 hours

**Unit Description**

This unit describes the competencies required by a technician in order to apply a wide range of electrical principles, using the concepts of D.C and A.C circuits in electrical installation, using basic electrical machine, using earthling in electrical installations and applying 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

**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 * AC to DC and DC to AC Conversion * Basic solar photovoltaic systems | * 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 * Special machines and their Applications * Electric Drives | * Assignments * Oral questioning * Supervised exercises * Written tests * Practical tests |
| 1. Use of earthling 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 lightening protection measures | * + Meaning of lightening   + Lightening strokes and their types   + Lightening protection components   + Testing a lightening system   + Application of lightening system   + Maintenance of lightening system | * Assignments * Oral questioning * Supervised exercises * Written tests |

**Suggested Methods of Instruction**

* 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/AGR/CC/08/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Prepare and Interpret Technical Drawings

**Duration of Unit:** 128hours

**Unit Description**

This unit covers the competencies required to prepare and interpret technical drawings. It involves competencies to select, use and maintain drawing equipment and materials. It also involves producing plain geometry drawings, solid geometry drawings, pictorial and orthographic drawings of components and application of 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. Produce mechanical drawings
6. 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 * Identification and care of drawing 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 * 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. cylinders, prisms 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 and pictorial 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 * Assembly drawing * 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 * Electrical e.g. block, schematic, circuit, line and wiring | * Written test * Observation * Oral questioning * Written tests |

**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
* Computers installed with relevant CAD packages

# CORE UNITS OF LEARNING

# OPERATION OF AGRICULTURAL AND RELATED PRODUCTION MACHINERY AND EQUIPMENT

**UNIT CODE:** ENG/OS/AGR/CR/01/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Operate Agricultural and Related Production Machinery and Equipment

**Duration of Unit:** 120 hours

**Unit Description**

This unit covers the competencies required to operate agricultural and related production machinery and equipment. It involves selecting, preparing and operating agricultural production machinery, performing post operation activities and documenting post operation activities.

**Summary of Learning Outcomes**

1. Select agricultural production machinery and equipment

2. Prepare agricultural machinery and equipment for operation

3. Operate agricultural machinery and equipment

4. Perform post operation activities

5. Document post operation activities

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

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Select agricultural production machinery and equipment | * Meaning terms * Types of agricultural machinery and equipment * Land preparation * Planting * Cultivation * Weed and pest control * Power units in agricultural machinery and equipment * Classification of Agricultural soils * Factors to consider in selection of agricultural production machinery and equipment. * Soil types * Soil conditions * Crop types * Field size and terrain * Time * Whether conditions | * Written tests * Oral questioning * Observation * Practical tests |
| 1. Prepare agricultural machinery and equipment for operation | * Meaning of terms * Requirements in agricultural machinery and equipment preparation * Tasks and magnitude identification * Manufacturers manuals * Servicing tools and equipments * Consumables in agricultural machinery and equipment preparations * Time frame in machinery and equipment preparation | * Written tests * Observation * Oral questioning |
| 1. Operate agricultural machinery and equipment | * Meaning of terms * Skills and relevant regulations in operation of agricultural machinery and equipment * Factors to be considered in operation of Agricultural machinery and equipment e.g * Nature of the task to be performed * Procedures in machinery and equipment preparation * Soil type * Weather conditions * Terrain * Time of operation | * Written tests * Observation * Oral questioning |
| 1. Perform post operation activities | * Meaning of terms * Procedures in performing post operation activities * Post operation activities * Cleaning * Tightening * Greasing * Repair/Replacement * Storage * Timelines in operation of post operation activities | * Written tests * Observation * Oral questioning |
| 1. Document post operation activities | * Meaning of terms * Formats of preparation of post operation reports * Dissemination methods and filling | * Observation * Oral questioning * Practical tests * Written tests |

**Suggested Methods of Instruction**

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

**Recommended Resources**

* Fields
* Workshop
* Workshop tools and equipment
* Different agricultural machines
* Farm implements
* Consumables
* Standard
* Manuals
* Internet
* Occupational Safety and Health Act (OSHA
* National Environmental Management Authority (NEMA) regulations
* National Construction Authority (NCA) regulations
* Computer
* Printers
* Monitors
* Projectors
* Assorted protective devices
* Accessories

# CONSTRUCTION OF FARMSTEAD STRUCTURES AND FARM ROADS

**UNIT CODE:** ENG/OS/AGR/CR/02/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Construct Farmstead Structures and Farm Roads

**Duration of Unit:** 190 hours

**Unit Description**

This unit covers the competencies required to construct farmstead structures and farm roads. It involves conducting farmstead feasibility survey and planning, designing farmstead structures and roads, assembling farmstead construction tools and equipment, constructing farm roads linking farmstead structures, constructing designed farmstead structures, constructing farmstead amenities structures, testing and commissioning of constructed farmstead structures and roads and documenting farmstead construction report.

**Summary of Learning Outcomes**

1. Conduct farmstead feasibility survey and planning
2. Design farmstead structures and roads
3. Assemble farmstead construction tools and equipment
4. Construct farm roads linking farmstead structures
5. Construct designed farmstead structures
6. Construct farmstead amenities structures
7. Test and commission constructed farm stead structures and roads.
8. Document farmstead construction report

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

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Conduct farmstead feasibility survey and planning | * Meaning of terms * Factors to be considered in conducting feasibility survey e.g * Functionality and * Structure location * Clients requirements * Planning * Factors to be considered in conducting feasibility survey e.g * Clients requirements * Resources schedule | * Observation * Oral questioning * Written tests * Practical tests |
| 1. Design farmstead structures and roads | * Meaning of terms * Types of farmstead structures and roads * Factors to consider in designing farmstead structures and farm roads * Purpose * Types of soil * Structure functions * Techniques of water harvesting from farmstead structures * Terrain * Procedures in designing * Farm plan * Terrain * Cost in involved in designing farmstead structures and roads | * Observation * Oral questioning * Written tests * Practical tests |
| 1. Assemble farmstead construction tools and equipment | * Meaning of terms * Type and classification of construction tools and equipments * Tools functionality and tasks * Assembling priorities | * Observation * Oral questioning * Written tests * Practical tests |
| 1. Construct farm roads linking farmstead structures | * Meaning of terms * Procedures of construction of farmstead structures * Relevant tools and equipment in farm road construction * Types of construction materials and their availability * Road construction procedures * Drainage systems | * Observation * Oral questioning * Written tests * Practical tests |
| 1. Construct designed farmstead structures | * Meaning of terms * Types of farmstead structures * Relevant tools and equipment in farmstead structures construction * Construction materials and availability * Construction procedures * Farmstead structures construction procedures | * Observation * Oral questioning * Written tests * Practical tests |
| 1. Construct farmstead amenities structures | * Meaning of terms * Types farmstead amenities * Regulatory standards in construction of farmstead amenities e.g * NEMA * NCA | * Observation * Oral questioning * Written tests * Practical tests |
| 1. Test and commission constructed road and structures | * Meaning of terms * Testing procedures of the farmstead structures and roads * Elements of commissioning * Farm road inspections procedures * Training of end users | * Observation * Oral questioning * Written tests * Practical tests |
| 1. Document farmstead and road construction report | * Preparation of report * Dissemination of report * Report filing | * Observation * Oral questioning * Written tests * Practical tests |

**Suggested Methods of Instruction**

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

**Recommended Resources**

* Computers
* Printers
* Stationery
* Internet
* National and international standards
* Projectors
* Manuals

# **PRODUCE POST HARVEST ACTIVITIES**

**UNIT CODE:** ENG/OS/AGR/CR/03/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Perform Produce Post-Harvest Activities.

**Duration of Unit:** 130 hours

**Unit Description**

This unit covers the competencies required to perform produce post-harvest activities. It involves transporting farm produce, sorting, cleaning and grading of farm products, drying and farm produce, processing of farm produce, packaging of farm produce, storing farm produce and managing agricultural waste and by-products.

**Summary of Learning Outcomes**

1. Transport farm produce
2. Sort, clean and grade farm produce
3. Dry and cool farm produce
4. Process farm produce
5. Package farm produce
6. Handle farm produce
7. Store farm produce
8. Manage agricultural waste and by-product

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

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| * 1. Transport farm produce | * Meaning of terms * Types of produce * Factors to be considered in farm produce transportations * Timelines * Means of transport * Types of produces * Techniques and produce transportation means * Relevant regulations in produce transportation | * Written tests * Oral questioning * Practical tests * Observation |
| 1. Sort, clean and grade farm produce | * Meaning of terms * Requirement for sorting cleaning and grading * SOPs in sorting, cleaning and grading of farm produce * Marketing standards * Regulation in sorting , cleaning and grading * Types of machines and produce * Techniques in sorting, cleaning and grading of farm produce | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Dry or cool of farm produce | * Meaning of Terms * Preparation of produce for drying and cooling * Types of structures and equipment in drying and cooling of farm produce * Factors to be considered during drying and cooling of farm produce * Produce type * Timelines * Standards * Prevailing weather conditioning * Procedures in drying and cooling of farm produce * Testing techniques and standards of dried and cooled produce | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Process farm produce | * Meaning of teams * Preparation of farm produce for processing * Different methods of processing different farm produce * Standards in preparation for processing of farm produce * Procedures of preparing farm produce for processing * Identification of types of farm processing equipments * Factors to consider in processing farm produce * Timelines * Produce type * Processing equipment | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Package farm produce | * Meaning of terms * Methods of packaging farm produce * Type of the produce * Type of packaging material * Standards in packaging * Packaging machines * Produce packaging material * Standards in packaging e.g. * KEBS | * Written tests * Oral questioning * Practical tests |
| 1. Handle farm produce | * Meaning of terms * Factors that are considered during farm produce handling * Type of the farm produce * Stages of post harvesting * Type of produce handling equipment and material * Safety in produce handling | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Store farm produce | * Meaning of terms * Produce storage structures * Produce storage conditions * Storage handling machine and structures * Pest control measures | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Manage agricultural waste and by-product | * Meaning of term * Different methods of agricultural waste disposal * Regulations in agricultural waste disposal | * Observation * Oral questioning * Practical tests * Written tests |

**Suggested Methods of Instruction**

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

**Recommended Resources**

* Stationery
* Computers
* Manuals
* Projectors
* Internes
* Workshop tools and materials
* PPEs
* Occupational safety and health act (OSHA)
* Work injury benefits act (WIBA)
* Manufacturers’ catalogues
* British standards

# SOIL AND WATER CONSERVATION ACTIVITIES

**UNIT CODE:** ENG/CU/AGR/CR/04/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Perform Soil and Water Conservation Activities

**Duration of Unit:** 120 hours

**Unit Description**

This unit covers the competencies required to perform soil and water conservation activities. It involves designing soil and water conservation structures, identifying tools and equipment for soil and water conservation activities, controlling soil erosion, establishing water harvesting structures, rehabilitating degraded land and complying with relevant regulatory requirements.

**Summary of Learning Outcomes**

* + 1. Design soil and water conservation structures
    2. Identify tools and equipment for soil and water conservation activities
    3. Control soil erosion
    4. Establish water harvesting structures
    5. Rehabilitate degraded lands
    6. Comply with relevant regulatory requirement

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

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| * + 1. Design soil and water conservation structures | * Meaning of terms * Types of Soils and their characteristics * Design factors for soil and water conservation structures * Run off * Soil type * Catchment size * Vegetation cover * Terrain * Rainfall * Agricultural best practice * Downstream activities | * Observation * Oral questioning * Written tests |
| * 1. Identify tools and equipment for soil and water conservation activities | * Meaning of terms * Types of tools and equipment in soil and water conservation activities. * Identification of tools and equipment * Preparation and assembling of tools and equipment * Mobilization of tools and equipment * Sequence of operation * Workshop best practice for assembling | * Written tests * Oral questioning |
| * 1. Control soil erosion | * Meaning of terms * Techniques of soil erosion control * Materials used in soil erosion control * Implementing soil erosion control techniques * Factors to be considered in soil erosion * Climatic condition * Terrain * Materials * Soil type * Source of water * Agricultural practices | * Observation * Oral questioning * Written tests |
| * 1. Establish water harvesting structures | * Meaning of terms * Types of water harvesting structures * Selection and establishment factors for water harvesting structures * Terrain * Volume of water be harvested * Source of water to be harvested * Soil type * Use of water * Methods of water obstruction * Cost of the structure | * Observation * Oral questioning * Written tests |
| * 1. Rehabilitate degraded lands | * Meaning of Terms * Level degradation * Rehabilitation methods * Factors to be considered in rehabilitation of degraded land * Materials used for rehabilitation of degraded land e.g * Soil type and vegetation * Soil cover * Water retention measures * Techniques to be used in rehabilitation of degraded land * Factors to be considered water retention structures in rehabilitated land * Land topography * Soil cover | * Written tests * Oral questioning |
| * 1. Comply with relevant regulatory requirement | * Meaning of terms * Standards in soil erosion control and water conservation * Types of relevant regulatory bodies in soil erosion control and water conservation e.g * WARMA * KeRA * NEMA | * Written tests * Oral questioning |

**Suggested Methods of Instruction**

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

**Recommended Resources**

* Computers
* Printers
* Stationery
* Manufacturers’ catalogues
* Working drawings
* EMCA Act
* OSHA

# 

# TRACTORS AND POWER UNITS

**UNIT CODE:** ENG/CU/AGR/CR/05/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Demonstrate Understanding of Tractors and Power Units

**Duration of Unit:** 130 hours

**Unit Description**

This unit covers the competencies required to demonstrate understanding of tractors and power units. It involves classifying tractors operations, demonstrating understanding of tractors engine systems, demonstrate understanding of power units and transmission, applying ergonomic principles in machine and demonstrating understanding of tractors tests and operations.

**Summary of Learning Outcomes**

1. Classify tractors operation
2. Demonstrate understanding of tractor engine systems
3. Demonstrate understanding of power units and transmission
4. Apply Ergonomic principles in machine
5. Demonstrate understanding of tractor tests and operation

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

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| * + 1. Classify tractors operation | * Meaning of term * Classification of tracts * Factors for classification of tractors * Hose power rating * Manufacturer * Traction system | * Observation * Oral questioning * Written tests * Practical tests |
| 1. Demonstrate understanding of tractor engine systems | * Meaning of terms * Classification of tractors engine * Types of tractor engine * Operation of different tractor engine * Types of engine system * Tractors cooling system | * Observation * Oral questioning * Written tests * Practical tests |
| 1. Demonstrate understanding of power units and transmission | * Meaning of terms * Classification tractors power unit * Selection of tractors power units based on * Output * Functionality * Fuel consumption * Relationship between types of power transmission method and power units | * Observation * Oral questioning * Written tests * Practical tests |
| 1. Apply ergonomic principles in machine | * Meaning of terms * Operator machine operation relationship * Safe relationship in machine operation | * Observation * Oral questioning * Written tests * Practical tests |
| 1. Demonstrate understanding of tractor tests and operation | * Meaning of terms * Types of tractors tests * Factors that determine testing of tractors e.g * Engine output * Type of tractors * Testing location * Testing equipment * Preparation test report and interpretation | * Observation * Oral questioning * Written tests * Practical tests |

**Suggested Methods of Instruction**

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

**Recommended Resources**

* Stationery
* Manufacturers’ manuals
* Relevant catalogues
* National and international standards
* Computers
* Projectors

# IRRIGATION ACTIVITES

**UNIT CODE:** ENG/CU/AGR/CR/06/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Perform Irrigation Activities

**Duration of Unit:** 110 hours

**Unit Description**

This unit covers the competencies required to perform irrigation activities. It involves performing feasibility study, survey and planning, designing and preparing working drawings and seeking relevant approvals, preparing bills of quantities and cost estimates, supervising construction of irrigation system, testing and commissioning of irrigation system, preparing and documenting system operation report

**Summary of Learning Outcomes**

1. Perform feasibility study, survey and planning
2. Design and prepare working drawings and seek relevant approvals
3. Prepare bills of quantities and cost estimates
4. Supervise construction of irrigation system
5. Test and commission irrigation system
6. Prepare and document system operation report

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

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Perform feasibility study, survey and planning | * Meaning of Terms * Standards in feasibility study surveying and planning * Factors to be considered in conducting engineering surveying * Topography * Land cover * Equipment * Factors to be considered in conducting planning * Type of crop * Farm size * Surveying report * The type of the irrigation to be carried out * Permeability factors | * Observation * Written tests * Oral questioning * Practical tests |
| 1. Design and prepare working drawings and seek relevant approvals | * Meaning of terms * Types of soil and their characteristics * Types of irrigation systems * Design factors for irrigation * Type of crop * Crop water requirement * Type of irrigation systems * Drainage * Crop water requirement * Evapotranspiration * Relevant standards in irrigation system * Standards for working drawings * Approvals | * Observation * Written tests * Oral questioning * Practical tests |
| 1. Prepare bills of quantities and cost estimates | * Meaning of terms * Procedures for preparation of bills of quantities and tender document * Procedures for tendering * Material schedule * Report preparation and dissemination | * Observation * Written tests * Oral questioning * Practical tests |
| 1. Supervise construction of irrigation system | * Meaning of terms * Procedures in the supervision of construction of irrigation system * Material acquisition and quality control * Reference to working drawing * Preparation of progress report * Feedback on work progress * Quality of workmanship * “As constructed drawing” * Safety measures in installation of irrigation system | * Observation * Written tests * Oral questioning * Practical tests |
| 1. Test and commission irrigation system | * Meaning of terms * Procedures of testing and commissioning of irrigation systems * Standards in irrigation system testing * Tests to be carried out in irrigation system * Performance tests * System quality * Troubleshooting of installed irrigation system * Defect liability period * Elements of commissioning * Irrigation system inspections procedures * Training of the structures users | * Observation * Written tests * Oral questioning * Practical tests |
| 1. Prepare and document system operation report | * Report preparation * Report dissemination * Report filing * Training | * Observation * Written tests * Oral questioning * Practical tests |

**Suggested Methods of Instruction**

* Demonstration by trainer
* Practice by the trainee
* Discussions

**Recommended Resources**

* Computer
* Stationery
* Projectors
* Manuals
* National and internal standards
* Reference tables

# RENEWABLE ENERGY TECHNOLOGY IN AGRICULTURE

**UNIT CODE:** ENG/CU/AGR/CR/07/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Apply Renewable Energy in Agriculture

**Duration of Unit:** 72 hours

**Unit Description**

This unit covers the competencies required to apply renewable sources of energy in agriculture. It involves identifying sources of energy, designing energy harnessing structures, preparing construction materials and cost estimates, constructing energy harnessing structure, testing and commissioning constructed energy harnessing structure and preparing a report of the constructed structure.

**Summary of Learning Outcomes**

1. Identify sources of renewable energy
2. Design energy harnessing structures
3. Prepare construction materials and cost estimates
4. Construct energy harnessing structures
5. Test and commission constructed energy harnessing structures
6. Prepare a report of the constructed structures

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Identify sources of renewable energy | * Meaning of terms * Sources of renewable energy * Types of renewable energy sources * Factors to be considered in identify renewable energy sources | * Written tests * Oral questioning * Observation * Practical tests |
| 1. Design energy harnessing structures | * Meaning of terms * Type of energy harnessing structure * Design Factors for energy harnessing structures * Task requirement * Amount of energy to be generated * Site conditions and locations * Relevant standards, rules and regulations in renewable energy * Design approval * Good agricultural practices | * Observation * Oral questioning * Written tests |
| 1. Prepare construction materials and cost estimates | * Meaning of terms * Procedures for preparation of bills of quantities and tender document * Procedures for tendering * Material schedule * Report preparation and dissemination | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Construct energy harnessing structures | * Meaning of terms * Procedures in the supervision of construction of energy harnessing structure * Material acquisition and quality control * Reference to working drawing * Preparation of progress report * Feedback on work progress * Quality of workmanship * “As constructed drawing” * Safety measures in installation of irrigation system | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Test and commission constructed energy harnessing structures | * Meaning of terms * Procedures of testing and commissioning of energy harnessing structures * Standards in testing energy harnessing structures * Tests to be carried out in irrigation system * Performance tests * Timelines * Output * System quality * Defect liability in energy harnessing structures * Elements of commissioning * Energy harnessing structure inspections procedures * Training of the structures users | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Prepare a report of the constructed structures | * Report preparation * Report dissemination * Report filing * Training | * Observation * Oral questioning * Practical tests * Written tests |

**Suggested Methods of Instruction**

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

**Recommended Resources**

* Stationery
* Computers
* Projectors
* PPE
* Organization procedures manual
* National and internal standards
* Manuals
* Reference tables

# REFRIGERATION AND AIR CONDITIONING SYSTEMS

**UNIT CODE:** ENG/CU/AGR/CR/08/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Install Refrigeration and Air Conditioning System

**Duration of Unit:** 130 hours

**Unit Description**

This unit covers the competencies required to install refrigeration and air conditioning system. Competencies includes: conducting site survey for installation, designing refrigeration and air conditioning system, iinstalling electrical wiring for refrigeration and air conditioning, installing refrigeration and air conditioning system and finally testing installed system.

**Summary of Learning Outcomes**

1. Conduct site survey
2. Design refrigeration and air conditioning system
3. Install electrical wiring for refrigeration and air conditioning
4. Install refrigeration and air conditioning system
5. Test installed system

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| * 1. Conduct site survey | * Meaning of terms * Types of refrigeration and air conditioning systems * Factors to be considered in installation refrigeration an   air conditioning system   * Installation requirements * Site conditions * Tools, equipments and materials e.g brackets, hangers, frames (ceils) * Procedures of site surveying * Report preparation * Safety procedures | * Written tests * Oral questioning |
| * 1. Design refrigeration and air conditioning system | * Meaning of terms * Design Factors for refrigeration and air conditioning system * Task requirement * Site condition * Required amount of energy * Relevant standards, rules and regulations of regulatory bodies in designing refrigeration and air conditioning system * Design approval * Good agricultural practices | * Written tests * Oral questioning |
| 1. Install electrical wiring for refrigeration and air conditioning | * Meaning of terms * Types of electrical wiring * Wiring accessories * Safety measures in electrical wiring * Procedures for electrical wiring * IEE regulations in electrical wiring | * Observation * Oral questioning * Written tests |
| 1. Install refrigeration and air conditioning system | * Meaning of terms * Preparation of unit and components * Methods of installation * Procedures of installation of refrigeration unit and components * Standards and policies in installation of refrigeration and air conditioning system * Safety measures | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Test installed system | * Meaning of terms * Procedures of testing AC, temperature, velocity, sound and vibration * Work place procedures and policies * Service report preparation | * Observation * Oral questioning * Practical tests * Written tests |

**Suggested Methods of Instruction**

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

**Recommended Resources**

* Stationery
* Manuals
* Computers
* Projects
* PPE
* National and internal standards
* Organization procedures and tables

# **MANAGEMENT OF AGRICULTURAL ENGINEERING PROJECT**

**UNIT CODE:** ENG/CU/AGR/CR/09/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Manage Agricultural Projects

**Duration of Unit:** 120 hours

**Unit Description**

This unit covers the competencies required to manage an agricultural project. It involves preparing work plans and policies, managing project team, managing material, tools and equipment, managing project budget, supervising and assessing project implementation, preparing project reports and commissioning project.

**Summary of Learning Outcomes**

1. Prepare work plans and policies
2. Manage project team
3. Manage materials, tools and equipment
4. Manage project budget
5. Supervise and assess project implementation
6. Prepare project reports
7. Commission project

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

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| * + 1. Prepare work plans and policies | * Meaning of terms * Meaning of work planning and policies * SWOT analysis * Steps in work planning preparation * Scope identification * Goals and objects * Logistics establishment * Development of organization structure and policies * Time span * Project scheduling * Determination of project schedule using CPM and PERT | * Observation * Oral questioning * Practical tests * Written tests |
| * + 1. Manage project team | * Meaning of terms * Factors to be considered in establishment and management of the project team * Team specialization * Nature of the project * Time span * Project objects * Training of project team * Delegation of duties and activities | * Observation * Oral questioning * Practical tests * Written tests |
| * 1. Manage materials, tools and equipment | * Meaning of terms * Steps involved in management of project tool, equipment and materials * Identification of material tool and equipment * Classification and maintenance of project tools, equipment and materials * Material, tools and equipment auditing * Inventory control * Maintenance of project tools, materials and equipment * Standards involved in project tools, materials and equipment | * Observation * Oral questioning * Practical tests * Written tests |
| * 1. Manage project budget | * Meaning of terms * Project budget preparation * Procedure and steps involved in budget preparation * Cost control mechanism * Resource allocation * Communication on budget implementation | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Supervise and assess project implementation | * Procedures in the supervision of construction of irrigation system * Monitoring of project activities * Delegation of activities to team * Work quality assessment * Targets setting * Activity priority | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Prepare project reports | * Preparation of project report and dissemination * Preparation of operation manual | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Commission project | * Elements of project commissioning * Training | * Observation * Oral questioning * Practical tests * Written tests |

**Suggested Methods of Instruction**

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

**Recommended Resources**

* Stationeries
* Computers
* Projectors
* Manuals
* Occupational safety and health act (OSHA)
* Work injury benefits act(WIBA)
* Manufacturers’ catalogues
* British standards
* KEBS standards

# OPERATION OF AGRICULTURAL HARVESTING MACHINERY AND EQUIPMENT

**UNIT CODE:** ENG/OS/AGR/CR/10/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Operate Agricultural Harvesting Machinery And Equipment.

**Duration of Unit:** 120 hours

**Unit Description**

This unit covers the competencies required to operate agricultural harvesting machinery and equipment. It involves selecting agricultural harvesting machinery, preparing agricultural harvesting machinery for operation, operating agricultural harvesting machinery, performing post operation activities and documenting post operation activities.

**Summary of Learning Outcomes**

1. Select agricultural harvesting machinery
2. Prepare agricultural harvesting machinery for operation
3. Operate agricultural harvesting machinery
4. Perform post operation activities
5. Document post operation activities

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

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| * + - 1. Select agricultural harvesting machinery | * Meaning terms * Types of agricultural harvesting machinery based on: * Root crop * Legumes * Cereals * Hay and silage * Factors to consider in selection of agricultural harvesting machinery * Soil types * Soil conditions * Crop types * Field size and terrain * Time * Whether conditions | * Observation * Written tests * Observation * Oral questioning |
| 1. Prepare agricultural harvesting machinery for operation | * Meaning of terms * Requirements in agricultural harvesting machinery preparation * Tasks and magnitude identification * Manufacturers manuals * Servicing tools and equipments * Consumables in agricultural harvesting machinery preparations | * Observation * Written tests * Observation * Oral questioning |
| 1. Operate agricultural harvesting machinery equipment | * Meaning of terms * Skills and relevant regulations in operation of agricultural harvesting machinery * Standards in operation of agricultural harvesting machinery * Safety rules and regulations * Work place procedures * Operation manuals * Factors to be considered in operation of Agricultural harvesting machinery e.g * Nature of the task to be performed * Field condition * Crop type and its condition * Time of operation | * Observation * Written tests * Oral questioning |
| 1. Perform post operation activities | * Meaning of terms * Procedures in performing post operation activities * Post operation activities * Cleaning * Tightening * Greasing * Repair/Replacement * Storage * Timelines in operation of post operation activities | * Observation * Written tests * Oral questioning |
| 1. Document post operation activities | * Meaning of terms * Formats of preparation of post operation reports * Dissemination methods and filing | * Observation * Oral questioning * Practical tests * Written tests |

**Suggested Methods of Instruction**

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

**Recommended Resources**

* Computers
* Projectors
* Stationeries
* National and international standards
* Internet
* Fields
* Printers
* Workshop
* Manuals
* National Environmental Management Authority (NEMA)