

**REPUBLIC OF KENYA**

**NATIONAL OCCUPATIONAL STANDARDS**

**FOR**

**AGRICULTURAL TECHNICIAN**

**LEVEL 6**



TVET CDACC

P.O BOX 15745-00100

NAIROBI

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# FOREWORD

The provision of quality education and training is fundamental to the Government’s overall strategy for social economic development. Quality education and training will contribute to achievement 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 Technical and Vocational Education Training (TVET). 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 these National Occupational Standards was developed for the purpose of developing a competency-based curriculum for an Agricultural Engineering Level 6. These National Occupational Standards will also be the basis for assessment of an individual for competence certification.

It is my conviction that these National Occupational Standards will play a great role towards development of competent human resource for 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 and Sessional Paper No. 4 of 2016 on Reforming Education and Training in Kenya, emphasized the need to reform curriculum development, assessment and certification. This called for a shift to CBET in order to address the mismatch between skills acquired through training and skills needed by industry as well as increase the global competitiveness of Kenyan labor force.

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

The occupational standards are designed and organized with clear performance criteria for each element of a unit of competency. These standards also outline the required knowledge and skills as well as evidence guide.

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

**CHAIRPERSON, TVET CDACC**

# ACKNOWLEDGMENT

These Occupational Standards were developed through combined effort of various stakeholders from private and public organizations. I am thankful to the management of these organizations for allowing their staff to participate in this exercise. I wish to acknowledge the invaluable contribution of industry players who provided inputs towards the development of these Standards.

I thank TVET Curriculum Development, Assessment and Certification Council (TVET CDACC) for providing guidance on the development of these Standards. My gratitude goes to Agricultural Engineering Sector Skills Advisory Committee (SSAC) members for their contribution to the development of these Standards. I thank all the individuals and organizations who participated in the validation of these Standards not forgetting those from Agricultural Mechanization Services, division of Ministry of agriculture, JICA /Rice MAPP project in Mwea and Ostrich farm in Kajiado.

I acknowledge all other institutions which in one way or another contributed to the development of these Standards.

**CHAIRPERSON AGRICULTURAL ENGINEERING SECTOR SKILLS ADVISORY COMMITTEE**

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**ABBREVIATION AND ACRONYMS**

A Control version

AGR Agriculture

AIDS Acquired Immunodeficiency Syndrome

AMS Agricultural Mechanization Service

BC Basic unit of Competency

CBET Competency Based Education and Training

CC Common unit of Competency

CDACC Curriculum Development, Assessment and Certification Council

CEO Council Secretary

CPU Central Processing Unit

CR Core Unit of Competency

EHS Environmental Health and Safety Standards

ENG Engineering

GAP Good Agricultural practice

HIV Human Immuno-Deficiency Virus

IBMS Integrated Building Management System

ICT Information Communication Technology

IEE Institute of Electrical Engineers

KEBS Kenya Bureau of Standards

NCA National Construction Authority

OS Occupational Standard

OSH Occupational Safety and Health

OSHA Occupational Safety and Health Act

PESTEL Political Environmental Social Technological Economic Legal

PPE Personal Protective Equipment

SOP Standard Operating procedure

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/OS/AGR/BC/01/6/A

Industry or sector

Occupational Standards

Occupational area

Type of competency

Competency number

Competency level

Control Version

# 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 units of competency comprising agricultural engineering level 6 consists of the following basic, common and core units of competency as shown below:

**Basic Units of Competency**

|  |  |
| --- | --- |
| **Unit Code** | **Unit Title** |
| ENG/OS/AGR/BC/01/6/A | Demonstrate Communication Skills |
| ENG/OS/AGR/BC/02/6/A | Demonstrate Digital Literacy |
| ENG/OS/AGR/BC/03/6/A | Demonstrate Entrepreneurial Skills |
| ENG/OS/AGR/BC/04/6A | Demonstrate Employability Skills |
| ENG/OS/AGR/BC/05/6/A | Demonstrate Environmental Literacy |
| ENG/OS/AGR/BC/06/6/A | Demonstrate Occupational Safety and Health Practices |

**Common Units of Competency**

|  |  |
| --- | --- |
| **Unit Code** | **Unit Title** |
| ENG/OS/AGR/CC/01/6/A | Apply Engineering Mathematics |
| ENG/OS/AGR/CC/02/6/A | Perform Workshop Processes and Materials |
| ENG/OS/AGR/CC/03/6/A | Apply Mechanical Science Principles |
| ENG/OS/AGR/CC/04/6/A | Apply Fluid Mechanics Principles |
| ENG/OS/AGR/CC/05/6/A | Apply Thermodynamics Principles |
| ENG/OS/AGR/CC/06/6/A | Apply Material Science and Metallurgical Processes |
| ENG/OS/AGR/CC/07/6/A | Apply Electrical Principles |
| ENG/OS/AGR/CC/08/6/A | Prepare And Interpret Technical Drawing |

**Core Units of Competency**

|  |  |
| --- | --- |
| **Unit Code** | **Unit Title** |
| ENG/OS/AGR/CR/01/6/A | Operate Agricultural and Related Production Machinery |
| ENG/OS/AGR/CR/02/6/A | Construct Farmstead Structures and Farm Roads |
| ENG/OS/AGR/CR/03/6/A | Perform Produce Post-Harvest Activities |
| ENG/OS/AGR/CR/04/6/A | Perform Soil and Water Conservation Activities |
| ENG/OS/AGR/CR/05/6/A | Demonstrate Understanding of Tractors and Power Units |
| ENG/OS/AGR/CR/06/6/A | Perform Irrigation Activities |
| ENG/OS/AGR/CR/07/6/A | Apply Renewable Energy in Agriculture |
| ENG/OS/AGR/CR/08/6/A | Install Refrigeration and Air Conditioning System |
| ENG/OS/AGR/CR/09/6/A | Manage Agricultural Project |
| ENG/OS/AGR/CR/10/6/A | Operate Agricultural Harvesting Machinery and Equipment |

# BASIC UNITS OF COMPETENCY

# DEMONSTRATE COMMUNICATION SKILLS

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

**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.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 1. Meet communication needs of clients and colleagues | 1. Specific communication needs of clients and colleagues are identified and met based on workplace requirements 2. Different communication approaches are identified and applied according to clients’ needs 3. Conflict is identified and addressed as per the standards of the organization |
| 1. Develop communication strategies | * 1. Strategies for effective internal and external dissemination of information are developed as per organization’s requirements   2. Special communication needs are considered in developing strategies according workplace procedures   3. ***Communication strategies*** are analyzed, evaluated and revised based the workplace needs |
| 1. Establish and maintain communication pathways | * 1. Pathways of communication are established as per organization policy   2. Pathways are maintained and reviewed according to organization procedures |
| 1. Promote use of communication strategies | * 1. Information is provided to all areas of the organization as per strategy requirements   2. Effective communication techniques are articulated and modeled according work requirements   3. Personnel are given guidance about adapting communication strategies as per organization procedures |
| 1. Conduct interview | 1. A range of appropriate communication strategies are employed in ***interview situations*** based on the workplace requirements 2. Records of interviews are made and maintained in accordance with organizational procedures 3. Effective questioning, listening and nonverbal communication techniques are used as per needs |
| 1. Facilitate group discussion | 1. Mechanisms to enhance ***effective group interaction*** are identified and implemented according to workplace requirements 2. Strategies to encourage group participation are identified and used as per organizations’ procedures 3. Meetings objectives and agenda are set and followed based on workplace requirements 4. Relevant information is provided and feedback obtained according to set protocols 5. Evaluation of group communication strategies is undertaken in accordance with workplace guidelines 6. Specific communication needs of individuals are identified and addressed as per individual needs |
| 1. Represent the organization | 1. 7Relevant presentation are researched and presented based on internal or external communication forums requirements 2. Presentation is delivered in a clear and sequential manner as per the predetermined time 3. Presentation is made as per appropriate media 4. Difference views are respected based on workplace procedures 5. Written communication is done as per organizational standards 6. Inquiries are responded according to organizational standard |

**RANGE**

This section provides work environment and conditions to which the performance criteria apply. It allows for different work environment and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Communication strategies may include but not limited to: | * Language switch * Comprehension check * Repetition * Asking confirmation * Paraphrase * Clarification request * Translation * Restructuring * Approximation * Generalization |
| 1. Effective group interaction may include but not limited to: | * Identifying and evaluating what is occurring within an interaction in a nonjudgmental way * Using active listening * Making decision about appropriate words, behavior * Putting together response which is culturally appropriate * Expressing an individual perspective * Expressing own philosophy, ideology and background and exploring impact with relevance to communication |
| 1. Situations may include but not limited to: | * Establishing rapport * Eliciting facts and information * Facilitating resolution of issues * Developing action plans * Diffusing potentially difficult situations |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Communication
* Active listening
* Interpretation
* Negotiation
* Writing

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Communication process
* Dynamics of groups
* Styles of group leadership
* Key elements of communications strategy

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   1. Developed communication strategies to meet the organization requirements and applied in the workplace 2. Established and maintained communication pathways for effective communication in the workplace 3. Used communication strategies involving exchanges of complex oral information |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace or appropriately simulated environment where assessment can take place 2. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   1. Direct observation 2. Oral questioning 3. Written texts |
| 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. Off-the –job 3. During Industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

**DEMONSTRATE DIGITAL LITERACY**

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

**UNIT DESCRIPTION**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 1. Identify appropriate computer software and hardware | * 1. Concepts of ICT are determined in accordance with computer equipment   2. Classifications of computers are determined in accordance with manufacturers specification   3. Appropriate computer software is identified according to manufacturer’s specification   4. Appropriate computer hardware is identified according to manufacturer’s specification   5. Functions and commands of operating system are determined in accordance with manufacturer’s specification |
| 1. Apply security measures to data, hardware, software in automated environment | * 1. ***Data security and privacy are classified*** in accordance with the prevailing technology   2. ***Security threats*** reidentified ***and control measures*** are applied in accordance with laws governing protection of ICT   3. Computer threats and crimes are detected in accordance to Information Management security guidelines   4. Protection against computer crimes is undertaken in accordance with laws governing protection of ICT |
| 1. Apply computer software in solving tasks | * 1. ***Word processing concepts*** are applied in resolving workplace tasks, report writing and documentation as per the job requirements   2. ***Word processing utilities*** are applied in accordance with workplace procedures   3. Worksheet layout is prepared in accordance with work procedures   4. Worksheet is built and data manipulated in the worksheet in accordance with workplace procedures   5. Continuous data manipulated on worksheet is undertaken in accordance with work requirements   6. Database design and manipulation is undertaken in accordance with office procedures   7. Data sorting, indexing, storage, retrieval and security is provided in accordance with workplace procedures |
| 1. Apply internet and email in communication at workplace | * 1. Electronic mail addresses are opened and applied in workplace communication in accordance with office policy   2. Office internet functions are defined and executed in accordance with office procedures   3. ***Network configuration*** is determined in accordance with office operations procedures   4. Official World Wide Web is installed and managed according to workplace procedures |
| 1. Apply Desktop publishing in official assignments | * 1. Desktop publishing functions and tools are identified in accordance with manufactures specifications   2. Desktop publishing tools are developed in accordance with work requirements   3. Desktop publishing tools are applied in accordance with workplace requirements   4. Typeset work is enhanced in accordance with workplace standards |
| 1. Prepare presentation packages | * 1. Types of presentation packages are identified in accordance with office requirements   2. Slides are created and formulated in accordance with workplace procedures   3. Slides are edited and run-in accordance with work procedures   4. Slides and handouts are printed according to work requirements |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Appropriate computer hardware may include but not limited to: | Collection of physical parts of a computer system such as:   * Computer case, monitor, keyboard, and mouse * All the parts inside the computer case, such as the hard disk drive, motherboard and video card |
| 1. Data security and privacy may include but not limited to: | * Confidentiality of data * Cloud computing * Integrity -but-curious data surfing |
| 1. Security and control measures may include but not limited to: | * Counter measures against cyber terrorism * Risk reduction * Cyber threat issues * Risk management * Pass-wording |
| 1. Security threats may include but not limited to: | * Cyber terrorism * Hacking |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Analytical skills
* Interpretation
* Typing
* Communication
* Computing (applying fundamental operations such as addition, subtraction, division and multiplication)
* Using calculator
* Basic ICT skills

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Software concept
* Functions of computer software and hardware
* Data security and privacy
* Computer security threats and control measures
* Technology underlying cyber-attacks and networks
* Cyber terrorism
* Computer crimes
* Detection and protection of computer crimes
* Laws governing protection of ICT
* Word processing;
* Functions and concepts of word processing.
* Documents and tables creation and manipulations
* Mail merging
* Word processing utilities
* Spread sheets;
* Meaning, formulae, function and charts, uses and layout
* Data formulation, manipulation and application to cells
* Database;
* Database design, data manipulation, sorting, indexing, storage retrieval and security
* Desktop publishing;
* Designing and developing desktop publishing tools
* Manipulation of desktop publishing tools
* Enhancement of typeset work and printing documents
* Presentation Packages;
* Types of presentation Packages
* Creating, formulating, running, editing, printing and presenting slides and handouts
* Networking and Internet;
* Computer networking and internet.
* Electronic mail and world wide web
* Emerging trends and issues in ICT;
* Identify and integrate emerging trends and issues in ICT
* Challenges posed by emerging trends and issues

**EVIDENCE** **GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Identified and controlled security threats   2. Detected and protected computer crimes   3. Applied word processing in office tasks   4. Designed, prepared work sheet and applied data to the cells in accordance to workplace procedures   5. Opened electronic mail for office communication as per workplace procedure   6. Installed internet and World Wide Web for office tasks in accordance with office procedures   7. Integrated emerging issues in computer ICT applications   8. Applied laws governing protection of ICT |
| 1. Resource Implications | The following resources should be provided:   * 1. Access to relevant workplace where assessment can take place   2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Observation   2. Oral questioning   3. Written test   4. Portfolio of Evidence   5. Interview   6. Third party report |
| 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. Off-the –job 3. During Industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

**DEMONSTRATE ENTREPRENEURIAL SKILLS**

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

**UNIT DESCRIPTION**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT** | **PERFORMANCE CRITERIA** |
| 1. Demonstrate understanding of an Entrepreneur | 1. Entrepreneurs and Business persons are distinguished as per principles of entrepreneurship 2. ***Types of entrepreneurs*** are identified as per principles of entrepreneurship 3. Ways of becoming an Entrepreneur are identified as per principles of Entrepreneurship 4. ***Characteristics of Entrepreneurs*** are identified as per principles of Entrepreneurship 5. Factors affecting Entrepreneurship development are explored as per principles of Entrepreneurship |
| 1. Demonstrate understanding of Entrepreneurship and self-employment | 1. Entrepreneurship and self-employment are distinguished as per principles of entrepreneurship 2. Importance of self-employment is analysed based on business procedures and strategies 3. ***Requirements for entry into self-employment*** are identified according to business procedures and strategies 4. Role of an Entrepreneur in business is determined according to business procedures and strategies 5. Contributions of Entrepreneurs to National development are identified as per business procedures and strategies 6. Entrepreneurship culture in Kenya is explored as per business procedures and strategies 7. Born or made Entrepreneurs are distinguished as per entrepreneurial traits |
| 1. Identify Entrepreneurship opportunities | 1. Sources of business ideas are identified as per business procedures and strategies 2. Business ideas and opportunities are generated as per business procedures and strategies 3. Business life cycle is analysed as per business procedures and strategies 4. Legal aspects of business are identified as per procedures and strategies 5. Product demand is assessed as per market strategies 6. Types of ***business environment*** are identified and evaluated as per business procedures 7. Factors to consider when evaluating business environment are explored based on business procedure and strategies 8. Technology in business is incorporated as per best practice |
| 1. Create entrepreneurial awareness | 1. ***Forms of businesses*** are explored as per business procedures and strategies 2. Sources of business finance are identified as per business procedures and strategies 3. Factors in selecting source of business finance are identified as per business procedures and strategies 4. ***Governing policies*** on Small Scale Enterprises (SSEs) are determined as per business procedures and strategies 5. Problems of starting and operating SSEs are explored as per business procedures and strategies |
| 1. Apply entrepreneurial motivation | 1. ***Internal and external motivation*** factors are determined in accordance with motivational theories 2. Self-assessment is carried out as per entrepreneurial orientation 3. Effective communications are carried out in accordance with communication principles 4. Entrepreneurial motivation is applied as per motivational theories |
| 1. Develop innovative business strategies | 1. Business innovation strategies are determined in accordance with the organization strategies 2. Creativity in business development is demonstrated in accordance with business strategies 3. ***Innovative business strategies*** are developed as per business principles 4. Linkages with other entrepreneurs are created as per best practice 5. ICT is incorporated in business growth and development as per best practice |
| 1. Develop Business Plan | 1. Identified Business is described as per business procedures and strategies 2. Marketing plan is developed as per business plan format 3. Organizational/Management plan is prepared in accordance with business plan format 4. Production/operation plan in accordance with business plan format 5. Financial plan is prepared in accordance with the business plan format 6. Executive summary is prepared in accordance with business plan format 7. Business plan is presented as per best practice |

**RANGE**

This section provides work environment and conditions to which the performance criteria apply. It allows for different work environment and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Types of entrepreneurs may include but not limited to: | * Innovators * Imitators * Craft * Opportunistic * Speculators |
| 1. Characteristics of Entrepreneurs may include but not limited to: | * Creative * Innovative * Planner * Risk taker * Networker * Confident * Flexible * Persistent * Patient * Independent * Future oriented * Goal oriented |
| 1. Requirements for entry into self-employment may include but not limited to | * Technical skills * Management skills * Entrepreneurial skills * Resources * Infrastructure |
| 1. Internal and external motivation may include but not limited to: | * Interest * Passion * Freedom * Prestige * Rewards * Punishment * Enabling environment * Government policies |
| 1. Business environment may include but not limited to: | * External * Internal * Intermediate |
| 1. Forms of businesses may include but not limited to: | * Sole proprietorship * Partnership * Limited companies * Cooperatives |
| 1. Governing policies may include but not limited to: | * Increasing scope for finance * Promoting cooperation between entrepreneurs and private sector * Reducing regulatory burden on entrepreneurs * Developing IT tools for entrepreneurs |
| 1. Innovative business strategies may include but not limited to: | * New products * New methods of production * New markets * New sources of supplies * Change in industrialization |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Analytical
* Management
* Problem-solving
* Root-cause analysis
* Communication

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Decision making
* Business communication
* Change management
* Competition
* Risk
* Net working
* Time management
* Leadership
* Factors affecting entrepreneurship development
* Principles of Entrepreneurship
* Features and benefits of common operational practices, e. g., continuous improvement (kaizen), waste elimination,
* Conflict resolution
* Health, safety and environment (HSE) principles and requirements
* Customer care strategies
* Basic financial management
* Business strategic planning
* Impact of change on individuals, groups and industries
* Government and regulatory processes
* Local and international market trends
* Product promotion strategies
* Market and feasibility studies
* Government and regulatory processes
* Local and international business environment
* Relevant developments in other industries
* Regional/ County business expansion strategies

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | 1. Assessment requires evidence that the candidate: 2. Distinguished entrepreneurs and businesspersons correctly 3. Identified ways of becoming an entrepreneur appropriately 4. Explored factors affecting entrepreneurship development appropriately 5. Analysed importance of self-employment accurately 6. Identified requirements for entry into self-employment correctly 7. Identified sources of business ideas correctly 8. GeneratedBusiness ideas and opportunities correctly 9. Analysed business life cycle accurately 10. Identified legal aspects of business correctly 11. Assessed product demand accurately 12. Determined Internal and external motivation factors appropriately 13. Carried out communications effectively 14. Identified sources of business finance correctly 15. Determined Governing policy on small scale enterprise appropriately 16. Explored problems of starting and operating SSEs effectively 17. Developed Marketing, Organizational/Management, Production/Operation and Financial plans correctly 18. Prepared executive summary correctly 19. Determined business innovative strategies appropriately 20. Presented business plan effectively |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | 1. Written tests 2. Oral questions 3. Third party report 4. Interviews 5. Portfolio of Evidence |
| 1. Context of Assessment | Competency may be assessed   1. On-the-job 2. Off-the –job 3. During Industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# DEMONSTRATE EMPLOYABILITY SKILLS

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

**UNIT DESCRIPTON**

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.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 1. Conduct self-management | 1. Personal vision, mission and goals are formulated based on potential and in relation to organization objectives 2. Emotional intelligence is demonstrated as per workplace requirements. 3. Individual performance is evaluated and monitored according to the agreed targets. 4. Assertiveness is developed and maintained based on the requirements of the job. 5. Accountability and responsibility for own actions are demonstrated based on workplace instructions. 6. Self-esteem and a positive self-image are developed and maintained based on values. 7. Time management, attendance and punctuality are observed as per the organization policy. 8. Goals are managed as per the organization’s objective 9. Self-strengths and weaknesses are identified based on personal objectives |
| 1. Demonstrate interpersonal communication | 1. Writing skills are demonstrated as per communication policy 2. Negotiation and persuasion skills are demonstrated as per communication policy 3. Internal and external stakeholders’ needs are identified and interpreted as per the communication policy 4. Communication networks are established based on workplace policy 5. Information is shared as per communication policy |
| 1. Demonstrate critical safe work habits | * 1. Stress is managed in accordance with workplace policy.   2. Punctuality and time consciousness is demonstrated in line with workplace policy.   3. Personal objectives are integrated with organization goals based on organization’s strategic plan.   4. ***Resources*** are utilized in accordance with workplace policy.   5. Work priorities are set in accordance to workplace goals and objectives.   6. Leisure time is recognized and utilized in line with personal objectives.   7. ***Drugs and substances of abuse*** are identified and avoided based on workplace policy.   8. HIV and AIDS prevention awareness is demonstrated in line with workplace policy.   9. Safety consciousness is demonstrated in the workplace based on organization safety policy.   10. ***Emerging issues*** are identified and dealt with in accordance with organization policy. |
| 1. Lead a workplace team | 1. Performance targets for the ***team*** are set based on organization’s objectives 2. Duties are assigned in accordance with the organization policy. 3. ***Forms of communication*** in a team are established according to organization’s policy. 4. Team performance is evaluated based on set targets as per workplace policy. 5. Conflicts are resolved between team members in line with organization policy. 6. Gender related issues are identified and mainstreamed in accordance workplace policy. 7. Human rights and fundamental freedoms are identified and respected as Constitution of Kenya 2010. 8. Healthy relationships are developed and maintained in line with workplace. |
| 1. Plan and organize work | 1. Work plans are prepared based on activities and budget. 2. Assigned tasks are interpreted and expectations identified as per the workplace instructions. 3. Task occupational safety and health requirements are identified and observed regulations. 4. Work resources are identified, mobilized, allocated and utilized based on organization work plans. 5. Work activities are monitored and evaluated in line with work plans and workplace policy. 6. Work plans are reviewed based on target and available resources. |
| 1. Maintain professional growth and development | * 1. Personal training needs are identified and assessed in line with the requirements of the job.   2. ***Training and career opportunities*** are identified and utilized based on job requirements.   3. Resources for training are mobilized and allocated based organizations and individual skills needs.   4. Licensees and certifications relevant to job and career are obtained and renewed as per policy.   5. Work priorities and personal commitments are balanced and managed based on requirements of the job and personal objectives.   6. Recognitions are sought as proof of career advancement in line with professional requirements. |
| 1. Demonstrate workplace learning | * 1. Learning opportunities are sought and managed based on job requirement and organization policy.   2. Improvement in performance is demonstrated based on courses attended.   3. Application of learning is demonstrated in both technical and non-technical aspects based on requirements of the job   4. Time and effort is invested in learning new skills based on job requirements   5. Initiative is taken to create more effective and efficient processes and procedures in line with workplace policy.   6. New systems are developed and maintained in accordance with the requirements of the job.   7. Awareness of personal role in workplace ***innovation*** is demonstrated based on requirements of the job. |
| 1. Demonstrate problem solving skills | * 1. Creative, innovative and practical solutions are developed based on the problem   2. Independence and initiative in identifying and solving problems is demonstrated based on requirements of the job.   3. Team problems are solved as per the workplace guidelines   4. Problem solving strategies are applied as per the workplace guidelines   5. Problems are analyzed and assumptions tested as per the context of data and circumstances |
| 1. Manage ethical performance | * 1. Policies and guidelines are observed as per the workplace requirements   2. Self-worth and professionalism is exercised in line with personal goals and organizational policies   3. Code of conduct is observed as per the workplace requirements   4. Integrity is demonstrated as per legal requirement |

**RANGE**

This section provides work environment and conditions to which the performance criteria apply. It allows for different work environment and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Drug and substance abuse may include but not limited to: | Commonly abused   * Alcohol * Tobacco * Miraa * Over-the-counter drugs * Cocaine * Bhang * Glue |
| 1. Feedback may include but not limited to: | * Verbal * Written * Informal * Formal |
| 1. Relationships may include but not limited to: | * Man/Woman * Trainer/trainee * Employee/employer * Client/service provider * Husband/wife * Boy/girl * Parent/child * Sibling relationships |
| 1. Forms of communication may include but not limited to: | * Written * Visual * Verbal * Non verbal * Formal and informal |
| 1. Team may include but not limited to: | * Small work group * Staff in a section/department * Inter-agency group |
| 1. Personal growth may include but not limited to: | * Growth in the job * Career mobility * Gains and exposure the job gives * Net workings * Benefits that accrue to the individual as a result of noteworthy performance |
| 1. Personal objectives may include but not limited to: | * Long term * Short term * Broad * Specific |
| 1. Trainings and career opportunities may includes but not limited to | * Participation in training programs * Serving as Resource Persons in conferences and workshops |
| 1. Resource may include may but not limited to: | * Human * Financial * Technology |
| 1. Innovation may include but not limited to: | * New ideas * Original ideas * Different ideas * Methods/procedures * Processes * New tools |
| 1. Emerging issues may include but not limited to: | * Terrorism * Social media * National cohesion * Open offices |
| 1. Range of media for learning may include but not limited to: | * Mentoring * peer support and networking * IT and courses |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Interpersonal
* Communication
* Critical thinking
* Organizational
* Negotiation
* Monitoring
* Evaluation
* Record keeping
* Problem solving
* Decision Making
* Resource utilization
* Resource mobilization

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Work values and ethics
* Company policies
* Company operations, procedures and standards
* Occupational Health and safety procedures
* Fundamental rights at work
* Workplace communication
* Concept of time
* Time management
* Decision making
* Types of resources
* Work planning
* Organizing work
* Monitoring and evaluation
* Record keeping
* Gender mainstreaming
* HIV and AIDS
* Drug and substance abuse
* Professional growth and development
* Technology in the workplace
* Innovation
* Emerging issues

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   * 1. Conducted self-management   2. Demonstrated interpersonal communication   3. Demonstrated critical safe work habits   4. Demonstrated the ability to lead a workplace team   5. Planned and organized work   6. Maintained professional growth and development   7. Demonstrated workplace learning   8. Demonstrated problem solving skills   9. Demonstrated the ability to manage performance ethically |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   1. Observation 2. Oral questioning 3. Written test 4. Portfolio of Evidence 5. Interview 6. Third party report |
| 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. Off-the –job 3. During Industrial attachment |
| 1. Guidance information for assessment | | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# DEMONSTRATE ENVIRONMENTAL LITERACY

**UNIT CODE:** ENG/OS/AGR/BC/05/6/A

**UNIT DESCRIPTION**

This unit specifies the competencies required to demonstrate environmental literacy. It involves, controlling environmental hazard and environmental pollution, demonstrating 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 , analyzing resource use and developing resource conservation plans

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 1. Control environmental hazard | 1. Storage methods for environmentally hazardous materials are strictly followed according to environmental regulations and OSHS. 2. Disposal methods of hazardous wastes are followed according to environmental regulations and OSHS. 3. ***PPE*** is used according to OSHS. |
| 1. Control environmental Pollution | * 1. Environmental pollution ***control measures*** are implemented in accordance with international protocols.   2. Procedures for solid waste management are observed according Environmental Management and Coordination Act 1999   3. Methods for minimizing noise pollution is complied with based on Noise and Excessive Vibration Pollution and Control Regulations, 2009 |
| 1. Demonstrate sustainable resource use | * 1. Methods for minimizing wastage are complied with based on organizational waste management guide   2. Waste management procedures are employed following principles of 3Rs (Reduce, Reuse, Recycle)   3. Methods for economizing and reducing resource consumption are practiced as per the Constitution of Kenya 2010 Article 69 . |
| 1. Evaluate current practices in relation to resource usage | * 1. Information on resource efficiency systems and procedures are collected and provided as per work groups/sector   2. Current resource usage is measured and recorded as per work group   3. Current purchasing strategies are analyzed and recorded according to industry procedures.   4. Current work processes to access information and data is analyzed following enterprise protocol. |
| 1. Identify environmental legislations/conventions for environmental concerns | 1. Environmental legislations/conventions and local ordinances are identified according to the different environmental aspects/impact 2. Industrial standard/environmental practices are described according to the different environmental concerns |
| 1. Implement specific environmental programs | 1. Programs/Activities are identified according to organizations policies and guidelines. 2. Individual roles/responsibilities are determined and performed based on the activities identified. 3. Problems/constraints encountered are resolved in accordance with organizations’ policies and guidelines 4. Stakeholders are consulted based on company guidelines |
| 1. Monitor activities on Environmental protection/Programs | 1. Activities are periodically monitored and Evaluated according to the objectives of the environmental program 2. Feedback from stakeholders are gathered and considered in Proposing enhancements to the program based on consultations 3. Data gathered are analyzed based on Evaluation requirements 4. Recommendations are submitted based on the findings 5. Management support systems are set/established to sustain and enhance the program 6. Environmental incidents are monitored and reported to 7. concerned/proper authorities |
| 1. Analyze resource use | 1. All resource consuming processes are Identified as per the organizational work plan 2. Quantity and nature of resource consumed is determined based on processes 3. Resource flow is analyzed as per different parts of the process. 4. Wastes are classified according to NEMA regulations on waste management. |
| 1. Develop resource Conservation plans | 9.1. Efficiency of use/conversion of resources is determined according to industry protocol.  9.2. Causes of low efficiency of use of resources are Determined based on industry protocol.  9.3. Plans for increasing the efficiency of resource use are developed based on findings. |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. PPE may include but not limited to | * + Mask   + Gloves   + Goggles   + Safety hat   + Overall * Hearing protector |
| 1. Control measures may include but not limited to | * Methods for minimizing or stopping spread and ingestion of airborne particles * Methods for minimizing or stopping spread and ingestion of gases and fumes * Methods for minimizing or stopping spread and ingestion of liquid wastes |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Measuring
* Recording
* Analytical
* Monitoring
* Communication
* Writing

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* PPEs
* Environmental regulations
* OSHS
* Pollution
* Waste management
* Principle of 3Rs
* Types of resources
* Techniques in measuring current usage of resources
* Environmental hazards
* Regulatory requirements

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Controlled environmental hazard   2. Controlled environmental pollution   3. Demonstrated sustainable resource use   4. Evaluated current practices in relation to resource usage   5. Demonstrated knowledge of environmental legislations and local ordinances according to the different environmental issues /concerns.   6. Described industrial standard environmental practices according to the different environmental issues/concerns.   7. Resolved problems/ constraints encountered based on management standard procedures   8. Implemented and monitored environmental practices on a periodic basis as per company guidelines   9. Recommended solutions for the improvement of the program   10. Monitored and reported to proper authorities any environmental incidents |
| 1. Resource Implications | The following resources should be provided:   * 1. Workplace with storage facilities   2. Tools, materials and equipment relevant to the tasks (e.g. Cleaning tools, cleaning materials, trash bags)   3. PPE, manuals and references   4. Legislation, policies, procedures, protocols and local ordinances relating to environmental protection   5. Case studies/scenarios relating to environmental Protection |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   * 1. Observation   2. Oral questioning   3. Written test   4. Portfolio of Evidence   5. Interview   6. Third party report |
| 1. Context of Assessment | Competency may be assessed   1. On-the-job 2. Off-the –job 3. During Industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# DEMONSTRATE OCCUPATIONAL SAFETY AND HEALTH PRACTICES

**UNIT CODE:** ENG/OS/AGR/BC/06/6/A

**UNIT DESCRIPTION**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 1. Identify workplace hazards and risk | 1.1 ***Hazards*** in the workplace are identified ***based their indicators***  1.2 Risks and hazards are evaluated based on legal requirements.  1.3 ***OSH concerns*** raised by workers are addressed as per legal requirements. |
| 1. Control OSH hazards | 2.1 Hazard prevention ***and control measures*** are implemented as per legal requirement.  2.2 Risk assessment is conductedand a risk matrix developed based on likely impact.  2.3 ***Contingency measures***, including ***emergency procedures*** during workplace ***incidents and emergencies*** are recognized and established in accordance with organization procedures. |
| 1. Implement OSH programs | 3.1 Company OSH program are identified, evaluated and reviewed based on legal requirements.  3.2 Company OSH programs are implemented as per legal requirements.  3.3 Workers are capacity built on OSH standards and procedures as per legal requirements  3.4 ***OSH-related records*** are maintained as per legal requirements. |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Hazards may include but not limited to: | * Physical hazards – impact, illumination, pressure, noise, * vibration, extreme temperature, radiation * Biological hazards- bacteria, viruses, plants, parasites, mites, molds, fungi, insects * Chemical hazards – dusts, fibers, mists, fumes, smoke, gasses, vapors * Ergonomics * Psychological factors – over exertion/ excessive force,   awkward/static positions, fatigue, direct pressure,   * varying metabolic cycles * Physiological factors – monotony, personal relationship, work out cycle * Safety hazards (unsafe workplace condition) –confined space, excavations, falling objects, gas leaks, electrical, poor storage of materials and waste, spillage, waste and debris * Unsafe workers’ act (Smoking in off-limited areas, Substance and alcohol abuse at work) |
| 1. Indicators may include but not limited to: | * Increased of incidents of accidents, injuries * Increased occurrence of sickness or health complaints/ symptoms * Common complaints of workers related to OSH * High absenteeism for work-related reasons |
| 1. OSH concerns may include but not limited to: | * Workers’ experience/observance on presence of work hazards * Unsafe/unhealthy administrative arrangements (prolonged work hours, no break time, constant overtime, scheduling of tasks) * Reasons for compliance/non-compliance to use of PPEs or other OSH procedures/policies/guidelines |
| 1. Safety gears /PPE (Personal Protective Equipment) may include but not limited to: | * 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 |
| 1. Appropriate risk controls   may include but not limited to: | * Appropriate risk controls in order of impact are as follows: * Eliminate the hazard altogether (i.e., get rid of the dangerous machine) * Isolate the hazard from anyone who could be harmed (i.e., keep the machine in a closed room and operate it remotely; barricade an unsafe area off) * Substitute the hazard with a safer alternative (i.e., replace the machine with a safer one) * Use administrative controls to reduce the risk (i.e., train workers how to use equipment safely; train workers about the risks of harassment; issue signage) * Use engineering controls to reduce the risk (i.e., attach guards to the machine to protect users) * Use personal protective equipment (i.e., wear * gloves and goggles when using the machine) |
| 1. Contingency measures may include but not limited to: | * Evacuation * Isolation * Decontamination * (Calling designed) emergency personnel |
| 1. Incidents and emergencies may include but not limited to: | * Chemical spills * Equipment/vehicle accidents * Explosion * Fire * Gas leak * Injury to personnel * Structural collapse * Toxic and/or flammable vapors emission. |
| 1. OSH-related Records may include but not limited to: | * Medical/Health records * Incident/accident reports * Sickness notifications/sick leave application * OSH-related trainings obtained |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Communication
* Interpersonal
* Presentation
* Risk assessment
* Evaluation
* Critical thinking
* Problem solving
* Negotiation

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* General OSH Principles
* Occupational hazards/risks recognition
* OSH organizations providing services on OSH evaluation and/or work environment measurements (WEM)
* National OSH regulations; company OSH policies and protocols
* Systematic gathering of OSH issues and concerns
* General OSH principles
* National OSH regulations
* Company OSH and recording protocols, procedures and policies/guidelines
* Training and/or counseling methodologies and strategies

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   1. Identified hazards in the workplace based their indicators 2. Evaluated workplace hazards based on legal requirements. 3. Addressed OSH concerns raised by workers as per legal requirements. 4. Implemented hazard prevention and control measures as per legal requirement. 5. Conducted risk assessment as per legal requirement. 6. Developed risk matrix based on likely impact. 7. Recognized and established contingency measures in accordance with organization procedures. 8. Identified, evaluated and reviewed company OSH program based on legal requirements. 9. Implemented company OSH programs as per legal requirements. 10. Capacity built workers on OSH standards and procedures as per legal requirements 11. Maintained OSH-related records as per legal requirements. |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   1. Observation 2. Oral questioning 3. Written test 4. Portfolio of Evidence 5. Interview 6. Third party report |
| 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. Off-the –job 3. During Industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

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# COMMON UNITS OF COMPETENCY

# APPLY ENGINEERING MATHEMATICS

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

**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.

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| --- | --- |
| **ELEMENTS AND PERFORMANCE CRITERIAELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range.*** |
| * 1. Apply Algebra | 1. Calculations involving Indices are performed as per the concept 2. Calculations involving Logarithms are performed as per the concept 3. Scientific calculator is used in solving mathematical problems in line with manufacturer’s manual 4. Simultaneous equations are performed as per the rules 5. Quadratic equations are calculated as per the concept |
| * 1. Apply Trigonometry and hyperbolic functions | 1. Calculations are performed using trigonometric rules 2. Calculations are performed using ***hyperbolic functions*** |
| * 1. Apply complex numbers | * 1. Complex numbers are represented using Argand diagrams   2. Operations involving complex numbers are performed   3. Calculations involving complex numbers are performed using De Moivre’s theorem |
| 1. Apply Coordinate Geometry | * 1. Polar equations are calculated using coordinate geometry   2. Graphs of given polar equations are drawn using the Cartesian plane   3. Normal and tangents are determined using coordinate geometry |
| 1. Carry out Binomial Expansion | * 1. Roots of numbers are determined using binomial theorem   2. Errors of small changes are determined using binomial theorem |
| 1. Apply Calculus | * 1. Derivatives of functions are determined using Differentiation   2. Derivatives of hyperbolic functions are determined using differentiation   3. Derivatives of inverse trigonometric functions are determined using Differentiation   4. Rate of change and small change are determined using differentiation.   5. Calculation involving stationery points of functions of two variables are performed using differentiation.   6. Integrals of algebraic functions are determined using integration   7. Integrals of trigonometric functions are determined using integration   8. Integrals of logarithmic functions are determined using integration   9. Integrals of hyperbolic and inverse functions are determined using integration |
| 1. Solve Ordinary differential equations | * 1. First order and second order differential equations are solved using the method of undetermined coefficients   2. First order and second order differential equations are solved from given boundary conditions |
| 1. Apply Laplace transforms | * 1. Laplace transforms are solved using initial and final value theorems   2. Inverse Laplace transforms are solved using partial fractions   3. Differential equations are solved using Laplace transforms |
| 1. Apply Power Series | * 1. Power series are obtained using Taylor’s Theorem   2. Power series are obtained using Maclaurin’s theorem |
| 1. Apply Statistics | 1. Identification, Collection and Organization of data is performed 2. Interpretation, analysis and presentation of data in appropriate format is performed 3. Mean, median, mode and Standard deviation are obtained from given data 4. Calculations are performed based on Laws of probability 5. Calculation involving probability distributions, mathematical expectation sampling distributions are performed |
| 1. Apply Fourier Series | * 1. Fourier series coefficients are obtained using Fourier series techniques   2. Fourier series for 2π to T is are obtained using Fourier series techniques   3. Fourier series for odd and even functions are obtained using Fourier series techniques   4. Harmonic analysis is performed using numerical methods |
| 12.Apply Vector theory | * 1. Calculations involving vector algebra, dot and cross products using vector theory   2. Gradient, Divergence and Curl are obtained   3. Vector calculations are performed using Green’s theorem   4. Vector calculations are performed using Stoke’s theorem   5. Conservative vector fields and line and surface integrals are obtained using Gauss’s theorem |
| 1. Apply Matrix | * 1. Determinant and inverse of 3x3 matrix are obtained   2. Solutions of simultaneous equations are obtained   3. Calculation involving Eigen values and Eigen vectors are performed |
| 1. Apply Numerical methods | * 1. Roots of polynomials are obtained using iterative numerical methods   2. Interpolation and extrapolation are performed using numerical methods |
| 1. Apply concepts of probability for work | * 1. Probability events are determined from dependent, independent and mutually exclusive   2. Counting is done using permutation, combination, tree diagrams and Venn diagrams techniques |
| 1. Perform commercial calculations | * 1. Exchange rate calculations are done using devaluation and revaluation   2. Sales, stock turnover and profit and loss are determined   3. Incomes, salaries and wages are calculated |
| 1. Perform estimations, measurements and calculations of quantities | * 1. Measurement information in workplace is extracted and interpreted   2. Appropriate workplace measuring tools and equipment are identified and selected   3. Conversions are performed between units of measurement   4. Measurements are estimated and taken   5. Length, width, height, perimeter, area and angles of ***figures*** are calculated   6. Volume and surface area of figures are calculated   7. Information is recorded using mathematical language and symbols appropriate for the task |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Hyperbolic functions may include but not limited to: | * + Sinh x   + Cosh x   + Cosec x   + Coth x   + Tanh x   + Sech x |
| 1. Figures may include but not limited: | * + Triangles   + Squares   + Rectangles   + Circles   + Spheres   + Cylinders   + Cubes   + Polygons   + Cuboids   + Pyramids |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Applying fundamental operations (addition, subtraction, division, multiplication)
* Using and applying mathematical formulas
* Logical thinking
* Problem solving
* Applying statistics
* Drawing graphs
* Using different measuring tools

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Fundamental operations (addition, subtraction, division, multiplication)
* Calculating area and volume
* Types and purpose of measuring instruments
* Units of measurement and abbreviations
* Rounding techniques
* Types of fractions
* Types of tables and graphs
* Presentation of data in tables and graphs
* Vector operations
* Matrix operations

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills, knowledge and range.

|  |  |
| --- | --- |
| 1. 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   * 1. Applied Trigonometry and hyperbolic functions   2. Applied complex numbers   3. Determined angles and length in triangles   4. Applied Calculus   5. Solved Ordinary differential equations   6. Applied Laplace transforms   7. Applied Power Series   8. Applied Fourier Series   9. Applied Vector theory   10. Applied Matrix   11. Identified and selected measuring equipment   12. Collected, Analyzed and presented data   13. Applied Numerical methods |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   * 1. Direct Observation   2. Demonstration with Oral Questioning   3. Written tests |
| 1. Context of Assessment | Competency may be assessed   1. Off the job 2. On the job 3. During industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# PERFORM WORKSHOP PROCESSES AND MATERIALS

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

**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.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***(Bold and italicised terms are elaborated in the Range)*** |
| --- | --- |
| 1. Demonstrate understanding of workshop procedures | * 1. Workshop procedures and regulations are laid down as per the type of the workshop   2. Workshop rules and regulations are adhered to in all the workshop operations   3. ***Workshop safety rules and regulations*** are displayed in line with the workplace procedures   4. Workshop procedures on issuing and receiving of materials, tools and equipment are adhered to |
| 1. Demonstrate understanding of workshop machines | * 1. Workshop machines are identified as per their functions   2. Operation of workshop machine is performed as per the manufacture’s manuals   3. Maintenance of workshop machines is performed as per the manufacturer’s manuals |
| 1. Demonstrate understanding of workshop materials | * 1. Different workshop materials are established based on their properties   2. Workshop materials are applied in line with the nature of the job   3. ***Workshop materials*** are stored in adherence to the workshop procedures and manufacturers guidelines   4. Workshop materials are prepared based on the type of the task to be carried out. |
| 1. Fabricate farm tools and equipment | * 1. Type of equipment to be fabricated is identified best on the farm operation requirements   2. Design of the farm equipment to be fabricated is performed in line with the standard operating procedures   3. Tools, material and machine to perform the fabrication is established based on the type of the task to be carried out   4. Testing of the fabricated equipment is performed as per the expected output |
| 1. Prepare and document workshop activities reports | * 1. Report is prepared as per the approved format   2. Prepared report is shared with the relevant parties   3. Report is filed as per the organization filing system |
| 1. Maintain farm machinery and workshop tools and equipment | * 1. Maintenance of the farm Machinery is performed as per task expected to be carried out   2. Farm equipment are maintained in line with manufacturers manuals   3. Workshop tools, machines and instruments are maintained in line with workshop rules and procedures |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Workshop safety rules and regulations may include but not limited to: | * Rules regulating movements in the workshops * First Aid procedures * Tools handling rules |
| 1. Workshop materials may include but not limited to: | * Soldering wires * Different types of metals * Welding wires |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following additional skills:

* Assessing land and crop condition
* Reading and interpretation of manufacturer’s manuals on wok and maintenance
* Using appropriate fuel and lubricant requirement
* Appropriate PPE at different farm work
* Practicing safety practices and safe operation
* Preparing assessment report
* Planning
* Management
* Coordination
* Assessment of machine performance
* Waste segregation
* Maintaining work area
* Communications (verbal and written);
* Proficient in ICT;
* Time management;
* Analytical
* Faults troubleshooting
* Problem solving;
* Planning;
* Decision making;
* Report writing;
* Leadership

**Required Knowledge**

The individual needs to demonstrate knowledge and understanding of: • Maintenance of work area

* Record keeping procedure
* Data analysis and presentation
* Computer application packages
* Agricultural Project management
* Analysis and design methods
* Different firm tools and material
* Management of different wastes
* Preparing assessment report
* Coordination
* Waste segregation
* Maintaining work area
* Troubleshooting and practicing maintenance
* Information record keeping
* Planning
* Practicing 5s of good housekeeping and 3Rs
* Material recycling

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and understanding and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Adhered to the workshop rules and regulations in all the workshop operations   2. Adhered to workshop procedures on issuing and receiving of materials, tools and equipment   3. Identified workshop machines per their functions   4. Performed maintenance of workshop machines as per the manufacturers   5. Established different workshop materials based on their properties   6. Established tools, material and machine to perform the fabrication based on the type of the task that was to be carried out   7. Maintained farm equipment in line with manufacturers manuals |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Oral questioning   2. Practical demonstration   3. Observation |
| 1. Context of Assessment | Competency may be assessed   1. Off the job 2. On the job 3. During industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# APPLY PRINCIPLES OF MECHANICAL SCIENCE

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

**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.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range.*** |
| --- | --- |
| 1. Determine forces in a system | * 1. Forces are defined and described   2. ***Forces theorems*** are described   3. Resultant of coplanar forces is determined.   4. Calculation of distance, velocity and acceleration are performed   5. Application of different types of forces are determined |
| 1. Demonstrate the knowledge of moments | * 1. Moments are defined   2. Moments are calculated   3. Principles of moments are described   4. Couples are identified and applied in engineering systems. |
| 1. Demonstrate understanding of friction principles | * 1. Laws of friction are identified   2. Limiting friction is calculated   3. Forces applied at an angle to a horizontal plane are calculated   4. Coefficient of friction is calculated   5. Advantages and disadvantages of friction are identified. |
| 1. Demonstrate understanding of motions in engineering | * 1. Motion concepts are discussed   2. Laws of motion are identified   3. Motion calculations are performed   4. Displacement/time graphs are applied |
| 1. Describe work, energy and power | * 1. Work is calculated   2. Energy is calculated   3. Power calculations are performed |
| 1. Perform machine calculations | * 1. ***Problems on simple machines*** are solved   2. Problems on levers are solved   3. Laws of machines are identified |
| 1. Demonstrate understanding of gas principles | * 1. ***Gas laws*** are identified   2. Gas laws are applied in solving engineering problems   3. Uses of gases in engineering systems are identified |
| 1. Apply heat knowledge | * 1. Heat concepts are discussed   2. Working principle of heat is defined   3. Heat capacity is discussed   4. Heat problems are solved |
| 1. Apply density knowledge | * 1. ***Density terminology*** are discussed   2. Density measurements are carried out   3. Density problems are solved |
| 1. Apply pressure principles | * 1. Pressure concepts are discussed   2. Working principles of pressure is discussed   3. Pressure problems are solved   4. ***Pressure applications*** are identified |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Forces theorems may include but not limited to: | * + Parallelogram   + Triangle   + Polygon |
| 1. Problems on simple machines may include but not limited to: | * + Machine advantage   + Velocity ratio   + Efficiency |
| 1. Gas laws may include but not limited to: | * + Boyles law   + Charles law   + Gas equation |
| 1. Density terminology may include but not limited to: | * + Density   + Relative density |
| 1. Pressure applications may include but not limited to: | * + Vacuum pump   + Hydraulic pump   + Hydrometers |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Apply basic mechanical formulas
* Use of basic mechanical machines
* Perform various unit conversions of mechanical quantities
* Basic mechanical systems design
* Mechanical machine operation
* Logical thinking
* Problem solving
* Applying statistics
* Drawing graphs
* Using different measuring tools

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Newton’s law
* Levers
* Gear trains
* Laws of conservation of energy
* Laws of friction
* Type of forces
* Thermodynamics
* Calculation of fluid pressure and flow rate
* Mechanical advantage and efficiency calculations
* Properties of materials
* Gas laws
* SI units of mechanical energy.
* Power transmission systems
* Parameters of fluid system
* Operation of mechanical machines
* Mechanical calculation of power, energy, work done, torque and safety factor
* Units of measurement, conversions and abbreviations

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   * 1. Determined forces in a system   2. Demonstrated knowledge of moments   3. Understood friction principles   4. Understood motions in engineering   5. Described work, energy and power   6. Performed machine calculations   7. Demonstrated gas principles   8. Applied heat knowledge   9. Applied density knowledge   10. Applied pressure principles |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   * 1. Direct Observation   2. Demonstration with Oral Questioning   3. Case studies   4. Written tests |
| 1. Context of Assessment | Competency may be assessed   1. Off the job 2. On the job 3. During industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended |

# 

# APPLY PRINCIPLES OF FLUID MECHANICS

**UNIT CODE:** ENG/OS/AGR/CC/O4/6/A

**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.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range.*** |
| --- | --- |
| 1. Demonstrate understanding of flow in fluids | * 1. Flow rate in pipes is measured   2. Losses in pipes are determined   3. ***Causes of losses*** in pipes are determined   4. Flow losses equations are applied in problem solving |
| 1. Demonstrate knowledge in viscous flow | * 1. Viscous flow between parallel surfaces are explained   2. Viscous flow equations between parallel surfaces are derived and applied   3. Viscous flow equations in circular pipes are derived and applied in problem solving |
| 1. Perform dimensional analysis | * 1. Dimensional analysis is explained   2. Principle of dimensional homogeneity is explained   3. Fundamental dimensions are stated   4. Dimensional units are defined   5. ***Physical quantities*** are identified   6. Dimensional analysis are ***applied*** in problem solving |
| 1. Operate fluid pumps | * 1. ***Principle of operation*** of pumps is described   2. ***Reciprocating pump equation is*** ***derived***   3. ***Centrifugal pump equation is derived***   4. Pump equations are applied in problem solving |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Causes of losses may include but not limited to: | * + Friction   + Enlargement/reduction in cross-sectional areas |
| 1. Physical quantities may include but not limited to: | * + Mass   + Force   + Density   + Velocity   + Acceleration |
| 1. Applied may include but not limited to: | * + Reynolds number   + Mach number   + Froude number |
| 1. Principle of operation may include but not limited to: | * + Reciprocating   + Centrifugal |
| 1. Reciprocating pump equation is derived may include but not limited to: | * + Coefficient of discharge   + Percentage slip   + Work done   + Acceleration head   + Pressure head in the cylinder |
| 1. Centrifugal pump equation is derived may include but not limited to: | * + Effective head   + Manometric head   + Manometric efficiency   + Mechanical efficiency   + Discharge   + Torque   + Work done unit weight   + Specific speed |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Apply basic mechanical formulas
* Use of basic mechanical machines
* Perform various unit conversions of mechanical quantities
* Basic mechanical systems design
* Mechanical machine operation
* Logical thinking
* Problem solving
* Applying statistics
* Drawing graphs
* Using different measuring tools

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Newton’s law
* Levers
* Gear trains
* Laws of conservation of energy
* Laws of friction
* Type of forces
* Thermodynamics
* Calculation of fluid pressure and flow rate
* Mechanical advantage and efficiency calculations
* Gas laws
* SI units of mechanical energy.
* Power transmission systems
* Parameters of fluid system
* Operation of mechanical machines
* Mechanical calculation of power, energy, work done, torque and safety factor
* Units of measurement, conversions and abbreviations

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   * 1. Identified Principlesof mechanical science   2. Performed mechanical calculations of a system   3. Identified types of forces on a system   4. Calculated resultant forces on plane framework   5. Identified application of forces on the production flow   6. Tested mechanical properties of a materials   7. Identified tools and equipment for measuring system parameters   8. Recorded and interpreted measured parameters.   9. Operated Power transmission systems |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   * 1. Direct Observation   2. Demonstration with Oral Questioning   3. Case studies   4. Written tests |
| 1. Context of Assessment | Competency may be assessed   1. Off the job 2. On the job 3. During industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# APPLY THERMODYNAMICS PRINCIPLES

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

**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.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range.*** |
| --- | --- |
| 1. Understand fundamentals of thermodynamics | * 1. Terms used in thermodynamics are described   2. Thermodynamics processes and cycles are described   3. First law of thermodynamics is applied |
| 1. Perform steady flow processes | * 1. Steady flow energy equation is derived   2. Steady flow energy equation is applied in problem solving   3. Steady flow energy equation is applied in ***utilities*** |
| 1. Perform non steady flow processes | * 1. Non-flow energy equation is derived   2. Non-flow energy equation is applied in problem solving |
| 1. Understand perfect gases | * 1. ***Perfect gas laws*** are stated   2. Gas laws experiment are carried out   3. Gas laws are applied |
| 1. Generate steam | * 1. Dryness fraction is determined   2. Relationship between pressure and boiling point is determined   3. Energy balance is carried out   4. Relationship between temperature and pressure is determined. |
| 1. Perform thermodynamics reversibility and entropy | * 1. Thermodynamics reversibility is explained   2. Principles of heat engine are explained   3. Second law of thermodynamics is applied   4. Entropy is explained in thermodynamics cycle |
| 1. Understand ideal gas cycle | * 1. Ideal gas cycle processes are explained   2. Air standard efficiency and actual efficiency are differentiated   3. Problems are solved in ideal gas cycle |
| 1. Demonstrate understanding of fuel and combustion | * 1. Fuels are classified   2. Properties of fuels are described   3. Combustion equation are derived   4. Combustion equation is applied to combustion and exhaust gas problems |
| 1. Perform heat transfer | * 1. Conduction equation is derived and applied from Fourier’s law   2. Heat transfer equation is derived and applied from Newton’s law of cooling and Fourier’s law |
| 1. Understand heat exchangers | * 1. Heat exchangers are classified   2. Recuperative heat exchangers are described   3. Heat equations are applied to solve heat exchanger problems |
| 1. Understand air compressors | * 1. Air compressors are classified   2. ***Types of air compressors*** are described   3. Equations of reciprocating compressors are derived and applied |
| 1. Understand gas turbines | * 1. Theoretical cycle for gas turbines is explained   2. Open cycle gas turbine is described   3. Closed cycle gas turbine is described   4. Gas turbine equations are derived and applied |
| 1. Understand impulse steam turbines | * 1. ***Principles of operations*** of the impulse steam turbines is described   2. Impulse steam turbine equation is derived and applied |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Utilities may include but not limited to: | * + Boilers   + Condensers   + Compressors   + Nozzles   + Throttling processes |
| 1. Perfect gas laws may include but not limited to: | * + Boyle’s law   + Charle’s law   + Joule’s law |
| 1. Principles may include but not limited to: | * + Newton’s laws of motion   + Law of conservation of linear momentum   + Law of conservation of energy   + Archimedes’ principle |
| 1. Types of air compressors may include but not limited to: | * + Reciprocating   + Blowers   + Sliding valves   + Compounding   + Multistage impulse turbine |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Apply basic mechanical formulas
* Use of basic mechanical machines
* Perform various unit conversions of mechanical quantities
* Basic mechanical systems design
* Mechanical machine operation
* Logical thinking
* Problem solving
* Applying statistics
* Drawing graphs
* Using different measuring tools

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Newton’s law
* Levers
* Gear trains
* Laws of conservation of energy
* Laws of friction
* Type of forces
* Thermodynamics
* Calculation of fluid pressure and flow rate
* Mechanical advantage and efficiency calculations
* Gas laws
* SI units of mechanical energy.
* Power transmission systems
* Parameters of fluid system
* Operation of mechanical machines
* Mechanical calculation of power, energy, work done, torque and safety factor
* Units of measurement, conversions and abbreviations

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   * 1. Identified Principlesof mechanical science   2. Performed mechanical calculations of a system   3. Identified types of forces on a system   4. Calculated resultant forces on plane framework   5. Identified application of forces on the production flow   6. Tested mechanical properties of materials   7. Identified tools and equipment for measuring system parameters   8. Recorded and interpreted measured parameters.   9. Operated Power transmission systems |
| 1. Resource Implications | Competency may be assessed   1. Off the job 2. On the job 3. During industrial attachment |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   * 1. Direct Observation   2. Demonstration with Oral Questioning   3. Case studies   4. Written tests |
| 1. Context of Assessment | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# **APPLY MATERIAL SCIENCE AND METALLURGICAL** PROCESSES

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

**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.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key  outcomes which make up  workplace function | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements  ***(Bold and italicized terms are elaborated in the Range)*** |
| --- | --- |
| 1. Analyse properties of engineering materials | * 1. Type of engineering materials is identified as per the procedures   2. ***Physical properties*** of engineering material are determined   3. ***Mechanical properties*** of engineering materials are tested   4. Crystal structure of materials are analyzed |
| 1. Perform ore extraction processes | 1. Safety procedures are observed according OSHA 2. Method of extraction is determined as per material properties and its composition 3. Procedure in extraction process is determined as per extraction method 4. Extraction by- products are stored as per SOPs 5. Extraction by- products are disposed as per SOPs |
| 1. Produce iron materials | 1. Perform ore smelting according to standard operating procedures. 2. ***Composition of iron*** is determined 3. Method of producing ***iron material*** is established 4. Refinement processes are identified based on iron material required |
| 1. Produce alloy materials | * 1. Materials in alloy formation are identified   2. Alloy formation process is identified based on alloy to be produced   3. Alloy tested based on alloy production requirement |
| 1. Produce non-ferrous materials | * 1. ***Non-ferrous materials*** are extracted according to SOP   2. Extracted non-ferrous material is smelted and purified as per the SOP   3. Non-ferrous material is tested according to SOP   4. Alloying elements for non-ferrous materials are identified   5. Alloy formation process is identified based on alloy to be produced   6. Alloys for non-ferrous material are tested based on production requirement |
| 1. Produce ceramics materials | * 1. Composition of ***ceramic materials*** is identified   2. Manufacturing process is identified   3. Ceramic materials are produced according to manufacturing processes   4. ***Finishing processes*** are identified |
| 1. Produce composite materials | * 1. Type of composite to be produced is identified   2. Elements involve in composite formation are identified   3. Formation process of composite to be produced is identified   4. Composite is tested as per composite production requirement |
| 1. Utilise other engineering materials | * 1. Identify and select engineering material according to production requirements.   2. Operation plan is developed according to engineering drawing.   3. Appropriate machine is set up according to manufacturer’s manual   4. Production parameters are set according to production requirement |
| 1. Perform heat treatment | * 1. Safety practices are observed according to OSHA 2007   2. ***Heat treatment processes*** are identified   3. Procedures in heat treatment processes are established   4. Heat treatment of metals are performed |
| 1. Perform material testing | * 1. Safety is observed in material testing procedures   2. Material testing methods are identified depending on material to be tested   3. Procedure of material testing is followed as per material testing method   4. Material testing results are tabulated, calculated and interpreted   5. Material testing equipment are taken care of and maintained. |
| 1. Prevent material corrosion | * 1. Safety is observed during corrosion prevention   2. ***Corrosion type*** is identified   3. Corrosive atmosphere is identified   4. ***Methods of corrosion prevention*** are identified   5. Corrosion is prevented |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

|  |  |
| --- | --- |
| **VARIABLE** | **RANGE** |
| 1. Physical properties may include but not limited to: | * Density * Color * Texture * Melting point * Thermo conductivity * Electrical resistivity |
| 1. Mechanical properties may include but not limited to: | * Ductility * Malleability * Elasticity * Toughness * Hardness * Brittleness * Plasticity * Strength |
| 1. Composition of iron may include but not limited to: | * Iron (II) oxide * Iron (III) oxide |
| 1. Iron materials may include but not limited to: | * + Cast iron   + Steel |
| 1. Non-ferrous materials may include but not limited to: | * + Aluminium   + Copper |
| 1. Ceramic materials may include but not limited to: | * + Oxides   + nitrides   + carbides   + silica |
| 1. Finishing processes may include but not limited to: | * + Lapping   + Fine grinding   + Polishing |
| 1. Heat treatment processes may include but not limited to: | * + Annealing   + Tempering   + Normalizing   + Hardening   + Case hardening |
| 1. Corrosion types may include but not limited to: | * + Galvanic   + Stress corrosion cracking |
| 1. Methods of corrosion prevention may include but not limited to: | * + Painting   + Electroplating   + Galvinizing   + Cathodic   + Chromizing |

**REQUIRED KNOWLEDGE AND SKILLS**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills

* Measuring and marking
* Material testing
* Use of hand tools
* Inspection and testing

**Required Knowledge**

The individual needs to demonstrate knowledge and understanding of:

* Occupational Health and Safety Act of Kenya laws 2007 with focus on personal safety, machine safety and workplace
* National Environment Management Authority Act, Kenya 2004
* OSH ACT 2007
* Equipment manuals
* Mathematics & science
* Physics and mechanics
* Metallurgy and materials
* Inspection and testing
* WIBA ACT
* Report writing

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the learner   * 1. Observed safety as per work place procedures   2. Demonstrated understanding of physical, chemical and mechanical properties of engineering materials   3. Performed extraction processes   4. Produced iron materials   5. Produced ceramics   6. Produced composites   7. Produced alloys   8. Performed heat treatment   9. Performed material testing   10. Demonstrated understanding of corrosion types and its prevention |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | Competency may be accessed through:   * 1. Oral questioning   2. Written test   3. Practical tests |
| 1. Context of Assessment | Competency may be assessed   1. Off the job 2. On the job 3. During industrial attachment |
| 1. Guidance information for assessment | Holistic assessment of other units relevant to the industry sector, workplace and job role is recommended. |

**APPLY ELECTRICAL PRINCIPLES**

**UNIT CODE:** ENG/OS/AGR/CC/07/6/A

**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

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range.*** |
| --- | --- |
| * + 1. Use the concept of basic Electrical quantities | * 1. Basic ***SI unit***s in Electrical are identified   2. ***Quantitie***s of Charge, force, work and power are identified   3. Perform calculations involving Ohm’s law i.e Current, Resistance and voltage   4. Calculations involving various electrical quantities are performed   5. Electrical quantities measuring instruments are identified |
| * + 1. Use the concepts of D.C and A.C circuits in electrical installation | * 1. Calculations involving parallel and series circuits are performed   2. Calculations involving Network theorems are performed. E.g. Kirchoff’s laws, Superposition, Thevinin’s, Norton’s   3. Photovoltaic solar system is identified   4. AC to DC and DC to AC conversion is performed |
| 1. Use of basic electrical machine | * 1. Types of various electrical machines are identified   2. Operations involving single phase and three phase AC and DC Motors are performed   3. Calculations involving single and three phase AC and DC transformers are performed   4. Operations involving single and three phase generators are performed   5. AC and DC machines are applied as per their functions |
| 1. Use of earthing in Electrical installations | * 1. Earthing types are identified   2. Earthing points on Electrical installation are identified   3. Calculation involved in determining the earthing type is performed   4. Test on an earthing system is performed in line with the IEE regulations |
| 1. Apply lightning protection measures | * 1. Types of lightening strokes are identified   2. Components of lightening protection system are identified   3. Test to be carried out in lightening protection system are established   4. Application of lightening protection system is determined |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. SI unit may include but not limited to: | * + Power – Watts (W)   + Current – Amperes (A)   + Resistance – Ohms(Ω)   + Voltage – Volts (V) |
| 1. Quantities may include but not limited to: | * + Charge   + Force   + Work   + Power |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Apply basic Electrical formulas
* Use of basic Electrical instruments
* Perform various unit conversions of Electrical quantities
* Electrical earthing
* Lightening arrestors
* Power factor correction
* logical thinking
* problem solving
* applying statistics
* drawing graphs
* Using different measuring tools

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Electrical power calculations
* Various laws in Electrical engineering
* Electrical formulas
* Power triangle
* SI units of various electrical parameters
* Earthing testing
* Lightening arrestor testing
* Selecting the correct type of electrical machines for various uses
* Types and purpose of measuring instruments
* Units of measurement and abbreviations

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   * 1. Applied the correct SI units of Electrical quantities   2. Stated, Calculate and relates the quantities in Ohm’s law   3. Identified the components of an earthing system   4. Stated and apply various laws in Electrical system   5. Differentiated between AC and DC network   6. Applied correct formulas in the calculation of AC and DC machines   7. Identified types of lightening arrestors and their applications |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   * 1. Direct Observation   2. Demonstration with Oral Questioning   3. Written tests |
| 1. Context of Assessment | Competency may be assessed   1. Off the job 2. On the job 3. During industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# PREPARE AND INTERPRET TECHNICAL DRAWINGS

**UNIT CODE:** ENG/OS/AGR/CC/08/6/A

**UNIT DESCRIPTION**

This unit covers the competencies required to prepare and interpret technical drawings. It involves using and maintaining drawing equipment and materials, producing plain geometry drawings, solid geometry drawings, pictorial and orthographic drawings and applying Computer Aided Design (CAD) packages.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***(Bold and italicised terms are elaborated in the Range)*** |
| --- | --- |
| 1. Use and maintain drawing equipment and materials | 1.1 ***Drawing equipment*** are identified and gathered according to task requirements  1.2 ***Drawing materials*** are identified and gathered according to task requirements  1.3 Drawing equipment are used and maintained as per manufacturer’s instructions  1.4 Drawing materials are used as per workplace procedures  1.5 Waste materials are disposed in accordance with workplace procedures and ***environmental legislations***  1.6 ***Personal Protective Equipment*** is used according to occupational safety and health regulations |
| 1. Produce plane geometry drawings | * 1. Different types of lines used in drawing and their meanings are identified according to standard drawing conventions   2. Different types of ***geometric forms*** are constructed according to standard conventions   3. Different types of angles are constructed according to principles of trigonometry   4. Different types of angles are measured using appropriate measuring tools   5. Angles are bisected according to standard conventions   6. Freehand sketching of different types of geometric forms, tools, equipment, diagrams is conducted |
| 1. Produce solid geometry drawings | * 1. Drawings of patterns are interpreted according to standard conventions   2. Patterns are developed in accordance with standard conventions |
| 1. Produce orthographic and pictorial drawings | * 1. Symbols and abbreviations are identified and their meaning interpreted according to standard drawing conventions   2. First and third angle orthographic drawings are interpreted and produced in accordance with the standard conventions   3. Orthographic elevations are dimensioned in accordance with standard conventions   4. Isometric drawings are interpreted and produced in accordance with standard conventions   5. Assembly drawing is produced and interpreted in line with the operating standards |
| 1. Produce mechanical drawings | * 1. Mechanical symbols and abbreviations are identified and their meaning interpreted according to BS 3939   2. Mechanical drawings are produced in accordance with BS 3939 |
| 1. Apply CAD packages | * 1. CAD packages are selected according to task requirements   2. CAD packages are applied in production of electrical drawings |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

| **Variable** | **Range** |
| --- | --- |
| 1. Drawing equipment may include but not limited to: | * Drawing boards * T and set squares * Drawing sets * Computers with CAD packages |
| 1. Drawing materials may include but not limited to: | * Drawing papers * Pencils * Erasers * Masking Tapes * Paper clips |
| 1. Environmental legislations may include but not limited to: | * EMCA 1999 |
| 1. Personal Protective Equipment may include but not limited to: | * Dust coats * closed leather shoes |
| 1. Geometric forms may include but not limited to: | * Circles * Triangles * Rectangles * Parallelogram * Polygons * Pyramids * Conic sections * prisms, loci |
| 1. Standard conventions may include but not limited to: | * Anatomy of engineering drawing (title block, coordinate grid system, revision block, notes and legends) * Drawing scale (paper size and drawing symbols) * International drawing standards |
| 1. Drawings may include but not limited to: | * Block * Schematic * line and wiring diagrams |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required skills**

The individual needs to demonstrate the following skills:

* Critical thinking
* Drawing
* Interpretation
* Drawing equipment handling
* Analysis and synthesis
* Communication
* Inter personal

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Drawing equipment and materials
* Freehand sketching
* Lettering
* Geometrical constructions
* Types of drawings
* Types of lines
* Isometric drawing conventions, features, characteristics, components
* Orthographic drawing conventions, features, characteristics, components
* Sketches and drawings of simple patterns

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required knowledge and understanding and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Applied and adhered to safety procedures   2. Cared and maintained drawing equipment   3. Interpreted drawings, assembly and lay out diagrams   4. Applied appropriate technical standards, used proper tools and equipment for a given task   5. Produced sketches and drawings   6. Applied CAD packages in production of drawings |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Practical tests   2. Observation |
| 1. Context of Assessment | Competency may be assessed   1. Off the job 2. On the job 3. During industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# CORE UNITS OF COMPETENCY

# OPERATE AGRICULTURAL AND RELATED PRODUCTION MACHINERY AND EQUIPMENT

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

**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.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***(Bold and italicised terms are elaborated in the Range)*** |
| --- | --- |
| 1. Select agricultural production machinery and equipment | * 1. Machinery and equipment are selected as per the power required for the task that is to be performed   2. Machinery and equipment are selected in line with the soil type   3. Machinery and equipment are selected as per the soil conditions   4. Machinery and equipment are selection as per the crop in the field   5. Machinery and equipment are selected as per the field landscape, terrain and size.   6. Selection is performed in line with weather and climate of the operation area   7. Selection is performed in line with the timing of various field operation |
| 1. Prepare agricultural machinery for operation | * 1. Preparation is performed in line with the task to be carried out   2. Preparation is performed as per the manufacturer’s manual   3. ***Machine consumables*** are considered in preparation of agricultural machines   4. Machinery and equipment are prepared in line with the duration of the task to worked on   5. Relevant machine servicing tools and equipment are considered in agricultural machine preparation |
| 1. Operate agricultural machinery and equipment | * 1. Machinery and equipment are operated as per the nature of the task to be performed   2. Agricultural Machinery are operated in line with the field conditions   3. Machinery and equipment are operated based on the skills, rules and regulations required.   4. Agricultural machines are operated in line with the safety rules and regulations aligned to that machine.   5. Machinery and equipment are operated in line the standard operating procedure   6. Machinery are operated in line with the workplace procedures |
| 1. Perform post operation activities | * 1. Cleaning of the Machinery and equipment is performed as per manufacturers manuals   2. Tightening, greasing and replacing of missing parts are performed line with the standard operating procedure   3. Machinery and equipmemt are stored according to manufacturer’s manuals   4. Machinery and equipment post operation activities are performed in line with the required timelines |
| 1. Document post operation activities | * 1. Post operation report is prepared as per the organization approved format   2. ***Post operation activities*** report is shared with the relevant parties   3. Report is filed in line with the organization filing system |

**RANGE**

This section provides work environment and conditions to which the performance criteria apply. It allows for different work environment and situations that will affect performance.

| **Variable** | **Range** |
| --- | --- |
| 1. Machine consumables may include but not limited to: | * Fuel * Oil * Grease * Coolants |
| 1. Post operation activities may include but not limited to: | * + Cleaning   + Greasing   + Oiling   + Tightening   + Unhitching |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following foundation skills:

* Preparing assessment report
* Determining and selecting agricultural Machinery based on land and crop conditions
* Assessing land and crop condition
* Reading and interpretation of manufacturer’s manuals on work and maintenance
* Using appropriate fuel and lubricant requirement
* Operating different agricultural machines
* Appropriate PPE at different farm work
* Practicing safety practices and safe operation
* Assessment of machine performance
* Waste segregation

**Required Knowledge**

The individual needs to demonstrate knowledge and understanding of:

* Field assessment procedures
* Different land condition
* Different crop condition
* Engine compatibility
* Walking tractor
* Different agricultural Machinery
* Machine assessment report preparation
* Procedure of checking and adjusting agricultural machines and accessories
* Engine and machine nomenclature
* Different farm tools and material
* Agricultural machine operation procedures
* Agricultural machine corrective procedure
* Machinery shutting down procedure
* Management of different wastes
* Procedure of cleaning and checking of Machinery and engine prior to storage
* Maintenance of work area
* Record keeping procedure
* Preventive maintenance for Machinery powered by small engine
* Data analysis and presentation
* Computer application packages
* Agricultural Project management
* Tendering and procurement
* Analysis and design methods
* Automation in farm Machinery

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and understanding and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Selected farm Machinery as per the field landscape, terrain and size.   2. Selected farm Machinery in line with weather and climatic condition of the operation area   3. Selected farm Machinery in line with the timing of various field operation   4. Machinery were selected as per the task to be undertaken   5. Selected farm Machinery as per the soil conditions   6. Machinery were selected as per the crop in the field   7. Prepared agricultural machine in line with the duration of the task to be undertaken   8. Prepared agricultural machine in line with the manufacturer’s operation manual   9. Agricultural Machinery were operated in line with the workplace procedures   10. Post operation report is shared with the relevant parties |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Observation   2. Oral questioning   3. Written test   4. Practical test |
| 1. Context of Assessment | Competency may be assessed   1. Off the job 2. On the job 3. During industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# CONSTRUCT FARMSTEAD STRUCTURES AND FARM ROADS

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

**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.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***(Bold and italicised terms are elaborated in the Range)*** |
| --- | --- |
| 1. Conduct farmstead feasibility survey and planning | * 1. Feasibility survey and planning is conducted in line with the client’s requirements   2. Farmstead feasibility, survey and planning is performed as per the functionality of the structure to be constructed.   3. Feasibility survey and planning are performed in line with the location of the structure   4. Planning is performed as per the schedule and timing of structure to be constructed   5. Planning is performed according to the client’s requirements   6. Planning is performed as per the availability and resource schedule |
| 1. Design farmstead structures and roads | * 1. Design is performed as per the feasibility survey plan report   2. Design is performed in line with the nature of the structure and the roads to be constructed   3. Design is performed in line with the functions of the structure and roads   4. ***Farmstead structure*** and roads are design in line with their cost estimates   5. Design is performed in line with water drainage of the structure   6. Farmstead structures and roads are designed in line with their location and terrain   7. Farmstead structures and roads are designed in line with the standard operating procedures   8. Farmstead structures and roads are designed in line with the farm plan   9. Design is performed as per the water harvesting techniques |
| 1. Assemble farmstead construction tools and equipment | * 1. Construction tools and equipment are identified as per the design   2. ***Construction tools*** and equipment are classified as per their functionality   3. Construction tools and equipment’s are prepared as per the nature of the task   4. Construction tools and equipment are assembled based on their order of priorities |
| 1. Construct farm roads linking farmstead structures | * 1. Farm roads are constructed in line with the design   2. Construction materials are established in line with their availability.   3. Construction tools and equipment are availed at the site as per the nature of the job to be carried out   4. Road construction procedures are adhered to   5. Farm roads drainage are constructed as per the standard operating procedures |
| 1. Construct designed farmstead structures | * 1. Farmstead structures are constructed as per the design   2. Farmstead structures construction procedures are adhered to   3. Construction tools and equipment are availed at the site as per the nature of the job to be carried out   4. Construction materials are established in line with their availability.   5. Water harvesting in construction of the farmstead structures is performed in line with the operating standard |
| 1. Construct farmstead amenities structures | * 1. Farmstead amenities are designed in line with the public health regulations   2. Waste disposal is performed as per the NEMA regulations   3. Farmstead amenities are constructed in line with the good agricultural practice |
| 1. Test and commission constructed farm stead structures and roads. | * 1. Testing is performed in conformity with the design   2. Testing is performed in line with the functionality   3. Farm roads are inspected as per the relevant standards   4. Testing is performed in adherence ***to good agricultural practice***   5. Commissioning is performed as per the expected output. |
| 1. Document farmstead construction report | * 1. Farmstead structures construction report is prepared in the approved format.   2. Farmstead structures report shared with the relevant parties   3. Farmstead report is filed as per the organization standard operating procedures |

**RANGE**

This section provides work environment and conditions to which the performance criteria apply. It allows for different work environment and situations that will affect performance.

| **Variable** | **Range** |
| --- | --- |
| 1. Farmstead structure may include but not limited to: | * Chemical store * Green house * Milking shed * Zero grassing unit * Biogas digester * Silos |
| 1. Construction tools may include but not limited to: | * Hammer * Spirit levels * Wheelbarrows |
| 1. Good agricultural practice may include but not limited to: | * Waste disposal * Produce storage * Chemical storage * Hygiene * Dress coat * Safe use |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following foundation skills:

* Preparing assessment report
* Assessing land and crop condition
* Using appropriate fuel and lubricant requirement
* Operating different agricultural machines
* Appropriate PPE at different farm work
* Practicing safety practices and safe operation
* Assessment of machine performance
* Waste segregation
* Maintaining work area
* Troubleshooting and practicing maintenance
* Material recycling
* Communications (verbal and written);
* Proficient in ICT;
* Troubleshooting
* Problem solving
* Decision Making
* Leadership
* Self-training

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Different land condition
* Different crop condition
* Different agricultural Machinery
* Different firm tools and material
* Agricultural machine operation procedures
* Record keeping procedure
* Agricultural Project management
* Analysis and design methods

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required knowledge and understanding and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Conducted feasibility survey and planning in line with the client’s requirements   2. Farmstead feasibility, survey and planning were performed as per the functionality of the structure.   3. Structure functions and road use were considered in the structure design   4. Designed farmstead structures and roads in line with their location and terrain   5. Prepared construction tools and equipment’s as per the nature of the task   6. Constructed farm roads in line with the design   7. Constructed farm roads drainage as per the standard operating procedures   8. Constructed farmstead structures are in line with the design   9. Designed farmstead amenities in line with the public health regulations   10. Constructed farmstead amenities in line with the good agricultural practice   11. Tested farmstead structures line with their functionality |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | Competency may be assessed through:  3.1 Observation  3.2 Oral questioning  3.3 Practical demonstration |
| 1. Context of Assessment | Competency may be assessed   1. Off the job 2. On the job 3. During industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# PERFORM PRODUCE POST HARVEST ACTIVITIES

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

**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.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***(Bold and italicised terms are elaborated in the Range)*** |
| --- | --- |
| 1. Transport farm produce | 1. Farm produce are transported in line with required timelines 2. Farm produce are transport in adherence to the EHS 3. Means of produce transport is established based on the nature of the produce 4. Farm produce are transported in line with the relevant ***Government regulations*** |
| 1. Sort, clean and grade farm produce | * 1. Sorting, cleaning and grading is performed in line with the standard operating procedures   2. Sorting, cleaning and grading of farm produce is performed in line required ***market standard***   3. Sorting, cleaning and grading of farm produce is performed in adherence of good agricultural practice   4. Sorting, cleaning and grading of farm produce is performed EHS   5. Sorting, cleaning and grading machines are identified in line with the produce |
| 1. Dry and cool farm produce | * 1. Farm produce are prepared for drying or cooling in line with their types and the standard operating procedures   2. Drying or cooling structures and equipment are established as per the produce to be dried   3. Farm produce are dried or cooled as per the types and the standard operating procedure   4. Farm produce are dried or cooling according to the required timelines   5. Testing of dried or cooling produce is performed in line with the required standard   6. Drying or cooling is done in line with the prevailing weather condition |
| 1. Process farm produce | * 1. Farm produce are prepared for processing in line with their types and the standard operating procedures   2. Farm processing equipment’s are identified as per the type of the produce   3. Farm produce are processed in line with the required timelines   4. Farm processing is performed as their type of the produce   5. Methods of different farm processing are identified as per the type of the produce |
| 1. Package farm produce | * 1. Produce are package according to the types   2. Packaging methods as determined in line with the farm produce   3. Packaging materials are determined in line with the KEBS and good agricultural practice standard   4. Packaging machines are established based on the produce to be packaged   5. Packaging is performed according to EHS standards |
| 1. Handle farm produce | * 1. Farm produce is handled as per their types and stages of handling   2. Farm produce is handled as per the type of packaging process   3. Produce is handled as per the type of storage   4. Produce is handled in line with the machine to be used |
| 1. Store farm produce | * 1. Produce storage methods are identified as per the type of the produce   2. Storage structures are established based on the produce to be stored   3. Produce storage handling machines are established base on the storage structures   4. Produce storage conditions are identified based on the type of the produce   5. Pest control measures in produce storage are established as per the good agricultural practices |
| 1. Manage agricultural waste and by-product | * 1. ***Agricultural waste*** to be managed are classified in line their type   2. Disposal methods of agricultural wastes are identified in line with the EHS standards   3. Agricultural wastes are recycled according to the good agricultural practice   4. Waste utilization methods are identified based on the types of produce processed   5. NEMA and Government rules and regulation are adhered to in waste disposal process |

**RANGE**

This section provides work environment and conditions to which the performance criteria apply. It allows for different work environment and situations that will affect performance.

| **Variable** | **Range** |
| --- | --- |
| 1. Government regulations may include but not limited to : | * Movement permits * Farm produce cess |
| 1. Market standard may include but not limited to : | * Client specification * Market demand |
| 1. Agricultural waste may include but not limited to : | * Cow dung * Rice husks |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following foundation skills:

* Operating different agricultural machines
* Appropriate PPE at different farm work
* Practicing safety practices and safe operation
* Assessment of machine performance
* Waste segregation
* Maintaining work area
* Troubleshooting and practicing maintenance
* Information record keeping
* Practicing 5s of good housekeeping and 3Rs
* Material recycling
* Management
* Leadership
* Coordination
* Problem solving
* Decision making
* Planning
* Report writing

**Required Knowledge**

The individual needs to demonstrate knowledge and understanding of:

* Field assessment procedures
* Different land condition
* Different crop condition
* Engine compatibility and hand tractor
* Different agricultural Machinery
* Machine assessment report preparation
* Procedure of checking and adjusting agricultural machines and accessories
* Engine and machine nomenclature
* Different firm tools and material
* Agricultural machine operation procedures
* Agricultural machine corrective procedure
* Machinery shutting down procedure
* Management of different wastes
* Procedure of cleaning and checking of Machinery and engine prior to storage
* Maintenance of work area
* Record keeping procedure
* Preventive maintenance for Machinery powered by small engine
* Data analysis and presentation
* Computer application packages
* Agricultural Project management
* Analysis and design methods

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required knowledge and understanding and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Transported farm produce in adherence to the EHS   2. Transported farm produce in line with the relevant Government regulations   3. Sorting, cleaning and grading of farm produce is performed EHS   4. Dried farm produces as per their types and the standard operating procedure   5. Dried farm produces according to the required timelines   6. Identified different methods of farm processing as per the type of the produce   7. Prepared farm produce for processing in line with their types and the standard operating procedures   8. Determined packaging materials in line with the KEBS and good agricultural practice standard   9. Performed packaging according to EHS standards   10. Established storage structures based on the produce to be stored   11. Established pest control measures in produce storage as per the good agricultural practices   12. Recycled agricultural wastes according to the good agricultural practice   13. Adhered to NEMA and Government rules and regulation in waste disposal process |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Observation with the help of check list   2. Practical demonstrations   3. Oral Questioning |
| 1. Context of Assessment | Competency may be assessed   1. Off the job 2. On the job 3. During industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# 

# PERFORM SOIL AND WATER CONSERVATION ACTIVITIES

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

**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.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***(Bold and italicised terms are elaborated in the Range)*** |
| --- | --- |
| 1. Design soil and water conservation structures | * 1. Design is performed in line with soil type and their characteristics   2. Design is performed as per the size of the catchment   3. Design is performed according to vegetation cover   4. Design is performed in line with the soil type in catchment.   5. Design is performed in line with the terrain of the structure location.   6. Design is performed according to the mean annual rain fall   7. Design is performed in adherence to the run-off expected and agricultural best practice   8. Downstream activities are considered in the design of water harvesting structures |
| 1. Identify tools and equipment for soil and water conservation activities | * 1. Tools and equipment are identified as per the best modern practices   2. Tools and equipment are identified based on the designed control method   3. Tools and equipment are prepared and assembled as per the nature of the job   4. Tools and equipment are mobilized in line with the nature of the job to be done   5. Tools are assembled in line with their sequence of operation   6. Tools and equipment are assembled as per the workshop best practice standards |
| 1. Control soil erosion | * 1. Methods of soil erosion control are identified as per the terrain and source of water   2. ***Materials in soil erosion control*** are established based on the soil type and terrain   3. Identified erosion control method is implement based on the design   4. Soil erosion control is performed based on the good agricultural practice   5. Soil erosion control is conducted according to the climatic condition of the location |
| 1. Establish water harvesting structures | * 1. Types of ***water harvesting structures*** are identified as per the terrain   2. Water harvesting structures are established by the volume of water to be harvested   3. Water harvesting structures are established based on the source of water to be harvested   4. Water to be harvested will be determined in line with the soil type   5. Water harvesting structures are determined by the use of water to be harvested   6. Method of water obstruction is determined by the terrain of the catchment   7. Water harvesting structures are established as per the cost estimate involved   8. Water harvesting structure is determined according to the volume of water to be harvested |
| 1. Rehabilitate degraded lands | * 1. Degraded land is rehabilitated as per its current ***soil condition***   2. Rehabilitation materials are established based on the soil type and condition   3. Water retention structures are established as per the land topography and soil cover |
| 1. Comply with relevant regulatory requirement | * 1. Soil erosion control and water conservation measures are performed in adherence to NEMA   2. Soil erosion control and water conservation are performed as per WARMA regulations   3. Soil erosion control and water conservation is conducted in adherence to KeRA rules and regulations   4. Soil erosion control and water conservation methods are conducted in line with good agricultural practice |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

| **Variable** | **Range** |
| --- | --- |
| 1. Materials in soil erosion control may include but not limited to: | * Stones * Sisal plant * Gabion boxes |
| 1. Water harvesting structures may include but not limited to: | * Earth dams * Water pan * Roof catchment * Rock catchment |
| 1. Soil condition may include but not limited to:: | * Texture * Structure * Permeability * Water retention capabilities |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Knowledge**

The individual needs to demonstrate knowledge and understanding of:

* Field assessment procedures
* Different land condition
* Different crop condition
* Engine compatibility and hand tractor
* Different agricultural Machinery
* Machine assessment report preparation
* Engine and machine nomenclature
* Different firm tools and material
* Agricultural machine operation procedures
* Agricultural machine corrective procedure
* Machinery shutting down procedure
* Maintenance of work area
* Record keeping procedure
* Data analysis and presentation
* Computer application packages
* Agricultural Project management

**Required Skills**

The individual needs to demonstrate the following additional skills:

* Communications (verbal and written);
* Preparing assessment report
* Determining and selecting agricultural Machinery based on land and crop conditions
* Reading and interpretation of manufacturer’s manuals on wok and maintenance
* Using appropriate fuel and lubricant requirement
* Operating different agricultural machines
* Appropriate PPE at different farm work
* Practicing safety practices and safe operation
* Assessment of machine performance
* Troubleshooting and practicing maintenance
* Information record keeping
* Decision making;
* Report writing;
* Creativity
* Self-driven

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and understanding and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Performed designing in adherence to the run-off expected   2. Established water retention structures as per the land topography and soil cover   3. Determined water harvesting structures as per the volume of water that was to be harvested   4. Established soil type in line with the water that was to be harvested   5. Determined method of water abstraction in line with the terrain of the source   6. Identified soil erosion control methods as per the terrain and source of water   7. Identified tools and equipment based on the designed control method   8. Applied soil erosion control measures in adherence to NEMA   9. Conducted soil erosion in adherence to KeRA rules and regulations   10. Applied soil erosion control method in line with good agricultural practice |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Oral questioning   2. Practical demonstration   3. Observation |
| 1. Context of Assessment | Competency may be assessed   1. Off the job 2. On the job 3. During industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# DEMONSTRATE UNDERSTANDING OF TRACTORS AND POWER UNITS

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

**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.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***(Bold and italicised terms are elaborated in the Range)*** |
| --- | --- |
| 1. Classify tractors operation | * 1. Tractors are classified in line to their horse power rating   2. Tractors are classified according to their functionality   3. Tractors are classified as per their traction system   4. Tractors are classified according to their manufacturers   5. Tractors are classified in line with general classification of ***farm Machinery*** |
| 1. Demonstrate understanding of tractor engine systems | * 1. Different types of engine systems are identified as per their operation   2. Tractor engine systems are classified as per their operations   3. Cooling systems of tractors are established based on their area of operation   4. Operation of different tractor engines is established according to their types and functionality |
| 1. Demonstrate understanding of power units and transmission | * 1. Power units are classified according to the tractors designed output   2. Tractors power units are determined as per their functionality   3. Power units are established based on the type of and volume of fuel consumption   4. Types of power transmission methods are determined as per the type of power units |
| 1. Apply ergonomic principles in machine | * 1. Relationship between the operator and machine is established based on the type of the machine during operation   2. Safety in machine operations is enhanced in line with the manufacturer’s operation manual |
| 1. Demonstrate understanding of tractor tests and operation | * 1. Tractor is tested as per the required engine output   2. Types of tests are identified based on the type of a tractors   3. Tractor ***test report*** is prepared and interpreted in line with the tests carried out.   4. Tractor testing position and place of testing is determined by the type of the tractor to be tested   5. Workshops available for testing carrying out tractor’s tests are established as per the type of tests expected |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

| **Variable** | **Range** |
| --- | --- |
| 1. Farm machinery may include but not limited to: | * Tractors * Falk lifters * Combine harvesters |
| 1. Test report may include but not limited to: | * Suitability test report * Performance test report |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Communications (verbal and written);
* Preparing assessment report
* Determining and selecting agricultural Machinery based on land and crop conditions
* Reading and interpretation of manufacturer’s manuals on wok and maintenance
* Using appropriate fuel and lubricant requirement
* Operating different agricultural machines
* Appropriate PPE at different farm work
* Practicing safety practices and safe operation
* Assessment of machine performance
* Troubleshooting and practicing maintenance
* Information record keeping
* Decision making;
* Report writing;

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Field assessment procedures
* Different land condition
* Different crop condition
* Engine compatibility and hand tractor
* Different agricultural Machinery
* Machine assessment report preparation
* Engine and machine nomenclature
* Different firm tools and material
* Agricultural machine operation procedures
* Agricultural machine corrective procedure
* Machinery shutting down procedure
* Maintenance of work area
* Record keeping procedure
* Data analysis and presentation

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and understanding and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Classified tractors in line to their horse power rating   2. Classified tractors according to their functionality   3. Tractor engine systems are classified as pert their operations   4. Established cooling systems of tractors based on their area of operation   5. Determined tractors power units as per their functionality   6. Determined types of power transmission methods as per the tractors type of power units   7. Types of tests are identified based on the type of a tractors   8. Prepared tractor test report and its interpretation in line with the tests carried out. |
| 1. Resource Implications | Competency may be assessed   1. Off the job 2. On the job 3. During industrial attachment |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Oral questioning   2. Practical demonstration   3. Observation |
| 1. Context of Assessment | Competency may be assessed   1. Off the job 2. On the job 3. During industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# PERFORM IRRIGATION ACTIVITES

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

**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.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***(Bold and italicised terms are elaborated in the Range)*** |
| --- | --- |
| 1. Perform feasibility study, survey and planning | * 1. Feasibility study is conducted in line with the standard operating procedures   2. Soil permeability is determined as per the types of irrigation to be carried out.   3. Surveying and planning is performed as per the profile and topography of the area to be irrigated   4. Planning is performed as per the type of crop to be grown and farm size to be irrigated   5. Planning is carried out in line with the feasibility and survey report |
| 1. Design and prepare working drawings and seek relevant approvals | * 1. Design is prepared in accordance with the soil permeability   2. Design is prepared according to the crop water requirement   3. Irrigation system is designed according to the type of irrigation to be carried out   4. Design and working drawings are prepared as per the ***engineering standards***   5. Approval are obtained from the relevant bodies |
| 1. Prepare bills of quantities and cost estimates | * 1. Bills of quantities are prepared in line with the design   2. Tender documents are prepared as per the bills of quantities generated   3. Tender advertisement is conducted as per the standard operating procedure   4. Report is prepared and shared with the relevant parties   5. Material schedule is prepared in line with the design and working drawings |
| 1. Supervise construction of irrigation system | * 1. Construction materials are acquired as per the working drawings   2. Supervision is conducted as per the working drawings   3. Construction progress report is prepared according to the client’s requirements   4. Reporting on work progress is performed as per the required procedure   5. Quality of materials and workmanship is carried out as per the design   6. ‘As constructed drawing’ is prepared in line with the adjustments made during construction   7. Safety measures are adhered to in line with agricultural good practice during installation of the irrigation system |
| 1. Test and commission irrigation system | * 1. Types of tests to be carried out are established as per the standard operating procedure   2. Quality performance of the irrigation system is carried out as per expected output   3. Performance test is carried out within the required timelines   4. Irrigation system is ***troubleshooted*** for errors after installation in line with good agricultural practice   5. Defect liability period is established as per the instruction to bidders |
| 1. Prepare and document system operation report | * 1. Report is prepared as per the approved format   2. Prepared report is shared with the relevant parties   3. Report is filed as per the organization filing system   4. Training manual is prepared according to system operation |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

| **Variable** | **Range** |
| --- | --- |
| 1. Engineering standards may include but not limited to: | * Standards in conduit fitting * Standard in designing irrigation system * Standards in structures construction |
| 1. Troubleshooting may include but not limited to: | * Refers to a systematic approach to problem solving that is often used to find and correct issues with machines, electronics, computers and software systems |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Preparing assessment report
* Determining and selecting agricultural Machinery based on land and crop conditions
* Reading and interpretation of manufacturer’s manuals on wok and maintenance
* Using appropriate fuel and lubricant requirement
* Appropriate PPE at different farm work
* Decision making;
* Report writing;
* Information record keeping
* Planning
* Management
* Leadership
* Coordination
* Assessment of machine performance
* Troubleshooting and practicing maintenance
* Operating different agricultural machines
* Assessment of machine performance
* Practicing safety practices and safe operation

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Machinery shutting down procedure
* Management of different wastes
* Procedure of cleaning and checking of machinery and engine prior to storage
* Maintenance of work area
* Record keeping procedure
* Preventive maintenance for machinery powered by small engine
* Data analysis and presentation
* Computer application packages
* Agricultural Project management
* Tendering and procurement
* Analysis and design methods
* Automation in farm machinery

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and understanding and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Performed engineering survey as per the profile and topography of the area to be irrigated   2. Determined soil permeability as per the types of irrigation that was to be per carried out.   3. Prepared the design according to the crop water requirement   4. Designed irrigation system according to the type of irrigation that was to be carried out   5. Prepared material schedule in line with the design and working drawings   6. Acquired construction materials as per the working drawings   7. Carried out quality of materials and workmanship as per the design   8. Conducted supervision of installation as per the working drawings   9. Carried out quality performance of the irrigation system as per expected output   10. Shared prepared report with the relevant parties   11. Perform irrigation system tests as per the design |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Oral questioning   2. Practical demonstration   3. Observation |
| 1. Context of Assessment | Competency may be assessed   1. Off the job 2. On the job 3. During industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# APPLY RENEWABLE ENERGY TECHNOLOGY IN AGRICULTURE

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

**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.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***(Bold and italicised terms are elaborated in the Range)*** |
| --- | --- |
| 1. Identify sources of renewable energy | * 1. ***Sources of renewable energy*** are identified as per the job requirements   2. Sources of renewable energy is identified based on the amount of energy generated by the energy source   3. Energy source is identified as per its sustainability   4. Renewable energy sources are identified as per the available resources   5. Types of renewable energy sources are identified as per available sources |
| 1. Design energy harnessing structures | * 1. Design is prepared according to the job requirement   2. Energy harnessing structures are designed according to the amount of energy required to be generated by the structure   3. Design and working drawing are performed as per the engineering standards   4. Energy harnessing structure is designed in line with the its locations   5. Energy harnessing structures are designed in adherence to good agricultural practice   6. Drawing approval are obtained from the relevant bodies   7. Energy harnessing structures are designed in line with the rules and regulations of relevant regulatory bodies |
| 1. Prepare construction materials and cost estimates | * 1. Bills of quantities are prepared in line with the design   2. Tender documents are prepared as per the bills of quantities generated   3. Tender advertisement is conducted as per the standard operating procedure   4. Report is prepared and shared with the relevant parties   5. Material schedule is prepared in line with the design and working drawings   6. Types of harnessing structure is identified |
| 1. Construct energy harnessing structures | * 1. Safety and precaution measures are adhered to as per the best workshop practice in preparation of the construction materials   2. Construction materials are acquired as per the working drawings   3. Supervision is conducted as per the working drawings   4. Construction progress report is prepared according to the client’s requirements   5. Reporting on work progress is performed as per the required procedure   6. Quality of materials and workmanship is carried out as per the design   7. ‘As constructed drawing’ is prepared in line with the adjustments made during construction |
| 1. Test and commission constructed energy harnessing structures | * 1. Types of tests to be carried out are established as per the standard operating procedure   2. Quality performance of the structure is carried out as per expected output   3. Testing is conducted after installation as per the expected output   4. Performance test is carried out within the required timelines   5. Defect liability period is established as per the instruction to bidders |
| 1. Prepare a report of the constructed structures | * 1. Report is prepared as per the approved format   2. Prepared report is shared with the relevant parties   3. Report is filed as per the organization filing system   4. Training manual is prepared according to the structure operation |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

| **Variable** | **Range** |
| --- | --- |
| 1. Sources of renewable energy may include but not limited to: | * Solar * Wind * Bio gas |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Different land condition
* Different crop condition
* Engine compatibility and hand tractor
* Different agricultural Machinery
* Machine assessment report preparation
* Procedure of checking and adjusting agricultural machines and accessories
* Engine and machine nomenclature
* Different firm tools and material
* Agricultural machine operation procedures
* Agricultural machine corrective procedure
* Machinery shutting down procedure
* Management of different wastes
* Procedure of cleaning and checking of Machinery and engine prior to storage
* Maintenance of work area
* Record keeping procedure

**Required Skills**

The individual needs to demonstrate the following skills:

* Using appropriate fuel and lubricant requirement
* Operating different agricultural machines
* Appropriate PPE at different farm work
* Practicing safety practices and safe operation
* Material recycling
* Planning
* Management
* Coordination
* Decision making;
* Report writing;
* Assessment of machine performance
* Waste segregation
* Maintaining work area
* Troubleshooting and practicing maintenance
* Information record keeping
* Practicing 5s of good housekeeping and 3Rs
* Leadership

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and understanding and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Identified sources of renewable energy as per the job requirements   2. Identified renewable energy sources as per the available sources   3. Prepared the design according to the job requirement   4. Designed energy harnessing structures according to the amount of energy required to be generated by the structure   5. Designed energy harnessing structure in line with its locations   6. Designed energy harnessing structures in adherence to good agricultural practice   7. Acquired construction materials as per the working drawings   8. Reported work progress is as per the required procedure   9. Shared prepared report with the relevant parties   10. Tested irrigation system within the required timelines |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Oral questioning   2. Practical demonstration   3. Observation |
| 1. Context of Assessment | Competency may be assessed   1. Off the job 2. On the job 3. During industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# INSTALL REFRIGERATION AND AIR CONDITIONING SYSTEMS

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

**UNIT DESCRIPTION**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms*** ***are elaborated in the Range*** |
| 1. Conduct site survey | * 1. ***Site conditions*** and ***installation requirements*** are assessed according to manufacturer’s specification and prevailing codes   2. ***Tools, equipment*** and ***materials*** needed for installation are determined according to site conditions and site installation requirements   3. Survey report is prepared in accordance with work the place policies and procedures   4. Safety procedures are adhered to according to OSHA |
| 1. Design refrigeration and air conditioning system | * 1. Design is prepared according to task requirement   2. Refrigeration air conditioning system is designed according to the amount of energy required.   3. Design and working drawing are performed as per the engineering standards and rules and regulation of relevant regulatory bodies   4. Refrigeration and air conditioning system is designed in line with the site conditions   5. Drawing approval are obtained from the relevant bodies   6. Refrigeration and air conditioning system structures are designed in line with the rules and regulations of relevant regulatory bodies |
| 1. Install electrical wiring for refrigeration and air conditioning | * 1. Electrical cabling and ***wiring devices*** are selected and safely installed in line with manufacturer's instructions   2. Power wiring is installed in accordance with applicable Electrical Code provisions   3. Electrical circuit is tested in accordance with applicable Electrical Code provisions |
| 1. Install refrigeration and air conditioning system | * 1. Tools equipment and materials are assembled according to work place procedures   2. ***Unit*** and components are prepared based on work place procedures   3. Refrigeration unit is installed according to work place procedures   4. Brackets, hangers and frames are installed in accordance with manufacturer’s specifications   5. Unit is positioned and leveled in line with manufacturer's specifications   6. ***Sealing materials*** are installed in line with manufacturer's instructions and specifications   7. ***Condensate drain*** is installed in accordance with manufacturer’s instructions and specifications   8. Safe manual handling techniques are employed in line with work place ***OS&H procedures***   9. 5s is exercised in line with work place policy |
| 1. Test installed system | * 1. Voltage and current are measured according to unit power requirements.   2. Temperature and velocity of air are measured based on unit specifications.   3. Sound and vibration are checked based on unit specifications   4. System is handed over to user as per work place procedures   5. ***Service report*** is prepared in line with work place policies and procedures. |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

|  |  |
| --- | --- |
| **VARIABLE** | **RANGE** |
| 1. Site conditions may include but not limited to: | * + Availability of power source and unit’s electrical provisions   + Wall and floor finishing provisions   + Drainage provisions   + Air circulation/ ventilation provision |
| 1. Installation requirements may include but not limited to: | * + Location   + wall and floor finishing   + Electrical requirements * A/C plug and outlet * Wire size * Protection devices * Grounding |
| 1. Tools and equipment may include but not limited to: | * + Measuring tools   + Spirit level   + Plumb bob   + Clear/Transparent water hose   + Screw drivers   + Chisel   + Hammers (claw and ballpeinn)   + Hacksaws   + Files   + Grinders   + Electric drills   + Drill bits   + Testing tools   + Cross cut saws   + Rip saws   + Arc welding equipment   + Brazing equipment   + Lok ring tools   + Masonry tools (e.g. trowel, spade, level, etc.) |
| 1. Materials may include but not limited to: | * + Expansion bolt   + Welding electrode (rod)   + Sealant   + Electrical cable   + Convenience outlets   + Electrical rails   + Circuit breakers   + Switches   + Masonry materials(e.g. cement, sand, etc.) |
| 1. Wiring devices may include but not limited to: | * + Service grounding   + Service outlet   + Service plug |
| 1. Unit may include but not limited to: | * + Window type air-conditioner   + Split type air- conditioner   + Refrigeration unit (e.g. refrigerator, water cooler, household freezer, etc.) |
| 1. Sealing materials may include but not limited to: | * + Rubber gasket   + Armaflex   + Foam   + Plastic   + Silicone |
| 1. Condensate drain may include but not limited to: | * + PVC pipe   + Plastic tubing   + Galvanized (G.I) pipe   + Metal tubing |
| 1. OS&H procedures may include but not limited to: | * + Wearing of PPE   + Lifting procedures   + Ladder safety   + Housekeeping |
| 1. Service report may include but not limited to: | * + Installation report   + Inspection report   + Testing report   + Commissioning report |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Interpreting plans and details
* Preparing materials
* Proper handling of tools and equipment
* Working safely
* Installing window-type and split-type air-conditioning and domestic refrigeration unit
* Testing power supply
* Connecting power circuit
* Operating window-type and split-type air-conditioning unit and domestic refrigeration unit
* Communicating effectively
* Decision making

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Personal protective equipment/safety gears
* Handling of tools, equipment and accessories
* Safety signs and symbols
* Good housekeeping
* Linear measurements
* Ratio and proportion
* Unit conversion
* Electrical plans, symbols and abbreviations
* Types of sealant
* Types of insulation
* Types of wires, conduits and fittings
* Types of wiring devices
* Basic refrigeration cycle
* Refrigeration and air conditioning components
* Basic electricity
* Basic masonry
* Basic carpentry
* Basic plumbing
* Basic arc welding
* Preventive Maintenance
* Relevant legislations

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   * 1. Adhered to safety procedures   2. Identified tools, equipment and materials   3. Assessed site conditions for air conditioning and refrigeration installation   4. Installed electrical wiring for refrigeration and air conditioning   5. Installed refrigeration system   6. Tested refrigeration system   7. Performed housekeeping |
| 1. Resource implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Methods of assessment | Competency may be assessed through:   * 1. Demonstration   2. Direct observation with oral questioning   3. Practical tests   4. Written tests   5. Third party reports |
| 1. Context for assessment | Competency may be assessed   1. Off the job 2. On the job 3. During industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# **MANAGE AGRICULTURAL ENGINEERING PROJECT**

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

**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.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***(Bold and italicised terms are elaborated in the Range)*** |
| --- | --- |
| 1. Prepare work plans and policies | * 1. Identify the scope of the work plan as per the nature of the project   2. Goals and objectives are established as per the nature of the project   3. ***Resources*** required are identified as per the nature of the project   4. Project ***logistics*** are established as per projects nature   5. Organization structure is developed as per the type of the project   6. ***Policies*** are developed as per the project standard operating procedure   7. Project schedule is established as per the complexity of the project |
| 1. Manage project team | * 1. Project team is identified as per the scope and area of specialization.   2. Job descriptions of the team are developed as per the nature of the project   3. Objectives of the project are communicated to the team as per the project policies.   4. Project activities are delegated in line with the standard operating procedure   5. OSHA is adhered to as per the nature of the project   6. Project team is trained on project activities as per the nature of the project   7. EHS is adhered to in line with the complexity of the project   8. SWOT analysis is performed as per the nature of the project |
| 1. Manage materials, tools and equipment | * 1. Tools , materials and equipment are identified as per the project activities   2. Auditing of tools, materials and equipment is performed as per the scope of the project   3. Tools, material and equipment inventory system is developed as per the nature of the project   4. Tools, materials and equipment are classified as per the project activities   5. Tools, materials and equipment are maintained in line with project policies.   6. EHS standards are adhered to in line with work place procedures |
| 1. Manage project budget | * 1. Budget is prepared as per the project requirement.   2. Cost control mechanism is developed as per the scope of the project   3. Miscellaneous activities are recorded as per the budget developed   4. Resource distribution is performed as per the project plan   5. Routine activities on budget implementation is communicated to the relevant parties as per the project policies |
| 1. Supervise and assess project implementation | * 1. Monitoring of project activities conducted as per the project work plan   2. Activitiesare delegated to team with their order of priority as per the project plan.   3. Quality of work is assessed as per the project standard operating procedures   4. Project team is directed on the expected output as per the work plan   5. Short range action steps are planned for as per project activities |
| 1. Prepare project reports | * 1. Progress reports are prepared as per the project activities   2. Project operation manual are documented and shared with the relevant parties |
| 1. Commission project | * 1. Hand-over documents are prepared and submitted to the relevant parties as per contract   2. Training of the project user is conducted in line with the project operation manual |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

| **Variable** | **Range** |
| --- | --- |
| 1. Resources may include but not limited to: | * + Finance   + Personnel   + Consultancy   + Materials   + Tools   + Storage facilities   + Buildings |
| 1. Logistics may include but not limited to: | * Transport * Security * Communication |
| 1. Policies may include but not limited to: | * + Work injury benefit act   + Disability policy   + Gender policy |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Risk management
* Project cycle
* Leadership
* Resource management
* Risk Evaluation
* Communications (verbal and written);
* Proficient in ICT;
* Planning;
* Decision making;
* First aid;
* Report writing;
* Project management
* Time management;
* Analytical
* Problem solving

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Organisational and legislative requirements including:
  + The manufacturer's warranty requirements relating to project management activities
  + The legal and statutory requirements relating to project management.
  + workplace procedures relevant to:
* Health and safety;
* The environment (including waste disposal);
* Appropriate personal and protective equipment;
* Workplace procedures for:
* Appropriate use of tools and equipment;
* Recording project activities
* Project quality control evaluation process
* Reporting of technical challenges
* The importance of documenting project implementation report
* The importance of working within agreed timelines and sharing progress reports.
* The relationship between time and costs.
* The importance of reporting anticipated delays to relevant parties promptly.
* The use of technical information including:
* How to find, interpret and use sources of technical information for project activities
* The importance of using the correct sources of technical information.;

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required knowledge and understanding and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Identified the resources required in a project   2. Prepared a project plan   3. Managed the project budget as per the project scope   4. Wrote and shared project report   5. Delegated project activities to the team   6. Assessed project quality and documented the results   7. Planned for project logistics |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Oral test   2. Observation   3. Practical demonstration |
| 1. Context of Assessment | Competency may be assessed   1. Off the job 2. On the job 3. During industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# OPERATE AGRICULTURAL HARVESTING MACHINERY AND EQUIPMENT

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

**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.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***(Bold and italicised terms are elaborated in the Range)*** |
| --- | --- |
| 1. Select agricultural harvesting machinery and equipment | * 1. Machinery and equipment are selected as per the power required for the task that is to be performed   2. Machinery and equipment are selected as per the crop type   3. Machinery and equipment are selected in line with the soil type   4. Machinery and equipment are selected as per the soil conditions   5. Machinery and equipment are selection as per the crop in the field   6. Machinery and equipment are selected as per the field landscape, terrain and size.   7. Selection is performed in line with weather and climate of the operation area   8. Selection is performed in line with the timing of various field operation |
| 1. Prepare agricultural harvesting machinery for operation | * 1. Preparation is formed in line with the task to be carried out   2. Preparation is performed as per the manufacturer’s manual   3. ***Consumables*** are considered in preparation of agricultural harvesting machines   4. Agricultural harvesting machinery and equipment are prepared in line with the duration of the task to worked on   5. Relevant servicing tools and equipment are considered in preparation of harvesting machinery and equipment |
| 1. Operate agricultural harvesting machinery equipment | * 1. Agricultural harvesting machinery and equipment are operated as per the nature of the task to be performed   2. Agricultural harvesting machinery and equipment are operated in line with the field conditions   3. Agricultural harvesting machinery and equipment are operated based on the skills, rules and regulations required.   4. Agricultural machinery and equipment are operated in line with the safety rules and regulations aligned to that machine.   5. Agricultural harvesting machinery and equipment are operated in line the standard operating procedure   6. Agricultural harvesting machinery and equipment are operated in line with the workplace procedures |
| 1. Perform post operation activities | * 1. Cleaning of the Machinery and equipment is performed as per manufacturers manuals   2. Tightening, greasing and replacing of missing parts are performed in line with the standard operating procedure   3. Machinery and equipment are stored according to manufacturer’s manuals   4. Machinery post operation activities are performed in line with the required timelines |
| 1. Document post operation activities | * 1. Post operation report is prepared as per the organization approved format   2. ***Post operation activities*** report is shared with the relevant parties   3. Report is filed in line with the organization filing system |

**RANGE**

This section provides work environment and conditions to which the performance criteria apply. It allows for different work environment and situations that will affect performance.

| **Variable** | **Range** |
| --- | --- |
| 1. Machine consumables may include but not limited: | * Fuel * Oil * Grease * Coolants |
| 1. Post operation activities may include but not limited: | * + Cleaning   + Greasing   + Oiling   + Tightening   + Unhitching |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Preparing assessment report
* Determining and selecting agricultural Machinery based on land and crop conditions
* Assessing land and crop condition
* Reading and interpretation of manufacturer’s manuals on work and maintenance
* Using appropriate fuel and lubricant requirement
* Operating different agricultural machines
* Appropriate PPE at different farm work
* Practicing safety practices and safe operation
* Assessment of machine performance
* Waste segregation

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Field assessment procedures
* Different land condition
* Different crop condition
* Engine compatibility
* Walking tractor
* Different agricultural machinery
* Machine assessment report preparation
* Procedure of checking and adjusting agricultural machines and accessories
* Engine and machine nomenclature
* Different farm tools and material
* Agricultural machine operation procedures
* Agricultural machine corrective procedure
* Machinery shutting down procedure
* Management of different wastes
* Procedure of cleaning and checking of machinery and engine prior to storage
* Maintenance of work area
* Record keeping procedure
* Preventive maintenance for machinery powered by small engine
* Data analysis and presentation
* Computer application packages
* Agricultural Project management
* Tendering and procurement
* Analysis and design methods
* Automation in farm Machinery

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and understanding and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Selected farm machinery as per the field landscape, terrain and size.   2. Selected farm machinery in line with weather and climatic condition of the operation area   3. Selected farm machinery in line with the timing of various field operation   4. Machinery were selected as per the task to be undertaken   5. Selected farm machinery as per the soil conditions   6. Machinery were selected as per the crop in the field   7. Prepared agricultural machine in line with the duration of the task to be undertaken   8. Prepared agricultural machine in line with the manufacturer’s operation manual   9. Agricultural machinery were operated in line with the workplace procedures   10. Post operation report was shared with the relevant parties |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Observation   2. Oral questioning   3. Written test   4. Practical test |
| 1. Context of Assessment | Competency may be assessed   1. Off the job 2. On the job 3. During industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |