



You Learn, We Standardize



NATIONAL OCCUPATIONAL STANDARD FOR AN AGRICULTURAL ENGINEER

NOS. AE.01
FIRST EDITION

APPROVING AUTHORITY

This National Occupational Standard has been prepared and published under the authority of the Zambia Qualifications Authority Board on 19th May 2022.

ZAMBIA QUALIFICATIONS AUTHORITY

The Zambia Qualifications Authority Act No. 13 of 2011 was enacted by the Government of the Republic of Zambia to ***“provide for the development and implementation of a national qualifications framework; establish the Zambia Qualifications Authority; provide measures to ensure that standards and registered qualifications are internationally comparable; and provide for matters connected with, or incidental to the foregoing”***. Among other functions, ZAQA is responsible for ***determining national standards for any occupation***, through various sector specific National Occupational Standards Development Teams (NOSDTs).

REVISION OF NATIONAL OCCUPATIONAL STANDARDS

National Occupational Standards shall be revised after every **5 years**, or whenever necessary, by the issue of either amendments or revised editions. It is important that users of National Occupational Standards (NOS) ascertain that they are in possession of the latest amendments or editions.

NOS DEVELOPMENT TEAM RESPONSIBLE

This National Occupational Standard was prepared by the Agriculture National Occupational Standards Development Team, upon which the following organisations were represented:

1. Agricultural Institution of Zambia (AIZ)
2. Aquaculture Development Association of Zambia (ADAZ)
3. CropLife Zambia
4. Ministry of Fisheries and Livestock (Department of Fisheries)
5. Golden Valley Agricultural Research Trust (GART)
6. Katete College of Agricultural Marketing
7. Ministry of Agriculture (Department of Agriculture)
8. Mulungushi University (MU)
9. Natural Resources Development College (NRDC)
10. University of Zambia (UNZA)
11. Veterinary Council of Zambia
12. Zambia Agriculture Research Institute (ZARI)
13. Zambia National Farmers Union (ZNFU)
14. Zambia Seed Trade Association (ZASTA)
15. Zambia Qualifications Authority (ZAQA)

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FOREWORD

The Zambia Qualifications Authority (ZAQA) is a statutory body under the Ministry of Education established by ZAQA Act No. 13 of 2011 to “**provide for the development and implementation of a national qualifications framework; provide measures to ensure that standards and registered qualifications are internationally comparable; and provide for matters connected with, or incidental to the foregoing**”.

Among other functions, ZAQA is responsible for “**determining national standards for any occupation**”, through various sector specific National Occupational Standards Development Teams (NOSDTs) of experts composed of representation from appropriate authorities, government departments, industry, academia, regulators, consumer associations and non-governmental organizations, etc.

This National Occupational Standard (NOS) has been developed by the Agriculture National Occupational Standards Development Team in accordance with the procedures and guidelines of ZAQA. All users should ensure that they have the latest edition of this publication as National Occupational Standards are revised from time to time.

This NOS shall be used by, among others, industry, employers, quality assurance bodies, awarding and professional bodies and education and training institutions, as a benchmark to identify training needs, develop job profiles/descriptions, develop curricula and learning programmes, in various sectors where the occupation exists. In the Agriculture sector, demonstration of competence against this NOS may be required in order to run a business or practice a craft or profession.

JUSTIFICATION

Agriculture contributes about 19 percent to the Gross Domestic Product (GDP) and employs three quarters of the population. Domestic production is comprised of crops such as maize, sorghum, millet, and cassava while sugar, soybeans, coffee, groundnuts, rice, and cotton as well as horticultural produce that drive exports. However, there has been a declining and static contribution of the agricultural sector to Zambia’s GDP which has been attributed to, among other things, poor technologies and lack of well-trained manpower in this sector. Some of the crucial actors are agricultural engineers who help in covering areas such as soil and water conservation, farm power and machinery, irrigation and drainage, agricultural structures, agricultural processing, and renewable energy, which are all crucial in enhancing the performance of the agricultural sector. Consequently, there is need for Agricultural Engineers that can help in the development of the country.

ACRONYMS AND ABBREVIATIONS

AE	Agricultural Engineer
CAD	Computer Aided Design
CS	Core Skill
EIZ	Engineering Institution of Zambia
EngRB	Engineering Registration Board
NOS	National Occupational Standard
NOSDT	National Occupational Standards Development Team
OK	Organizational Knowledge
PC	Performance Criteria
PS	Professional Skill
RK	Regulatory Knowledge
RPL	Recognition of Prior Learning
TK	Technical Knowledge
ZAQA	Zambia Qualifications Authority
ZQF	Zambia Qualifications Framework

GLOSSARY OF TERMS

For the purposes of this NOS, the following terms and definitions shall apply:

Core Skills/Generic Skills: are a group of skills that are key to learning and working in today's world. These skills are typically needed in any work environment. In the context of the NOS, these include communication related skills that are applicable to most job roles.

Function: is an activity necessary for achieving the key purpose of the sector, occupation, or area of work, which can be carried out by a person or a group of persons. Functions are identified through functional analysis and form the basis of NOS.

Job Title: defines a unique set of functions that together form a unique employment opportunity in an organisation.

Knowledge and Understanding: are statements which together specify the technical, generic, professional and organisational specific knowledge that an individual needs in order to perform to the required standard.

National Occupational Standards (NOS): are statements of the standards of performance individuals must achieve when carrying out functions in the workplace, together with specifications of the underpinning knowledge and understanding. They are precise descriptions of what an individual is expected to be able to do in his/her work role.

National Occupational Standards (NOS) Code: is a unique reference code that identifies a NOS.

National Occupational Standards Development Team (NOSDT): means an established group of national stakeholders/experts responsible for the development of National Occupational Standards within a specific economic sector or occupation.

Occupation: is a set of job roles, which perform similar/related set of functions in an industry.

Organisational Context: includes the way the organisation is structured and how it operates, including the extent of operative knowledge that managers have in their relevant areas of responsibility.

Performance Criteria: are statements that together specify the standard of performance required when carrying out a task.

Scope: is the set of statements specifying the range of variables that an individual may have to deal with in carrying out the function which have a critical impact on the quality of performance required.

Sector: is a conglomeration of different business operations having similar businesses and interests. It may also be defined as a distinct subset of the economy whose components share similar characteristics and interests.

Sub Sector: is derived from a further breakdown based on the characteristics and interests of its components.

Technical Knowledge: is the specific knowledge needed to accomplish specific designated responsibilities.

Unit Title: gives a clear overall statement about what the incumbent should be able to do.

1. OVERVIEW

This is an introductory section providing a brief summary and specific information or commentary about the content of the NOS and the targeted sector and occupation to help the user judge whether it is relevant to them.

NOS Code	NOS. AE.01
Occupation	Agricultural Engineer
Job Title	Agricultural Engineer
Job Description	Agricultural engineers solve problems concerning power supplies, machine efficiency, the use of structures and facilities, pollution and environmental issues, and the storage and processing of agricultural products.
Job Purpose	Agricultural engineers design agricultural machinery and equipment and develop methods to improve the production, processing and distribution of food and other agricultural products. They are involved in the conservation and management of energy, soil and water resources. These engineers design and use instruments to study the effects of light, humidity and temperature on plants and animals. They also design structures for crop storage and animal shelters. Some teach at universities and universities of technology.
ZQF Level	7
Sector	Agriculture
Sub sector	Agricultural Engineering
Other Economic Sector(s) in which the Occupation is Practiced	Water Utility Companies, Agricultural Equipment Providers, Councils (District, Municipal or City).
Other Similar Jobs that can be performed by a Agriculture Engineer	Sales Engineer, Practical Instructor, Researchers, Training Officers,
Minimum Educational Job Entry Qualification(s)	Bachelor's Degree in Agricultural Engineering
Practicing License Requirements (if any)	Membership with the Engineering Institution of Zambia (EIZ) and Practicing License from the Engineering Registration Board (EngRB).
Training/RPL	<ol style="list-style-type: none"> 1. Awareness of the Industry Standards and Rules and Regulations and their application 2. Use of ICTs (Internet, Computer packages, email, Computer Software and Hardware necessary for the job, etc.). 3. Quality Enhancement Methods.
Minimum Job Entry Age	21 years
Prior Experience	Minimum of 1year internship
Performance Criteria	As described in the Units under Section 4

2. SCOPE

This National Occupational Standard specifies the fundamental knowledge, understanding, skills and competences that an Agricultural Engineer must possess to be successful in his/her job role. It is applicable to an Agricultural Engineer working in public or private organisations; or is self-employed.

3. PERSONAL ATTRIBUTES (VALUES, ETHICS AND ATTITUDES)

This job requires an individual to possess:

- Creativity
- Problem solving skills
- Analytical skills
- Mathematics skills
- Integrity and respect for confidentiality
- Interpersonal skills
- Commercial Awareness
- Attention to details
- Ability to communicate effectively and clearly
- Self-motivated and team worker
- Ability to plan and prioritize,
- Quality consciousness
- Occupational health and safety oriented

4. UNITS AND ELEMENTS

This National Occupational Standard is divided into 8 Units representing the tasks that a job holder should undertake in his/her day to day work. Each unit is further broken down into elements depicting the number of activities to be carried out for the successful execution of a particular task. The 8 units are as follows:

UNIT 1 [This Unit is about Designing and Testing of Agricultural Systems, Components and Processes].

Unit No.	01
Unit Title	Designing and Testing of Agricultural Systems, Components and Processes
Description	This unit is about designing and testing of Agricultural Systems, Components and Processes
Scope	<p>This unit covers the following:</p> <ul style="list-style-type: none"> • Sketching and designing of products, tools, jigs and fixtures • Prototyping and testing • Process design. • Conducting experiments
Performance Criteria (PC) w.r.t. the Scope	
Element	Performance Criteria (PC)
Sketching and designing of products, tools, jigs and fixtures	<p>To be competent, the individual must be able to:</p> <p>PC1: Interpret product customer/market needs into a design brief</p> <p>PC2: Apply appropriate engineering concepts, processes, and principles to achieve the design brief</p> <p>PC3: Generate designs that conform to client/market requirements</p> <p>PC4: Create designs for client to choose from</p> <p>PC5: Organise the designs into suitable formats and with sufficient information to allow the client/superior to assess them</p> <p>PC6: Justify any variations from the design brief and give a suitable reason for them</p> <p>PC7: Diagnose faults and analyse engineering problems</p> <p>PC8: Provide design engineering solutions (sketch and design new products)</p> <p>PC9: Prepare work schedules and plans</p> <p>PC10: Prepare and maintain section/departmental staff competency skills matrix</p> <p>PC11: Ensure designs comply with all relevant regulations, standards directives or codes of practice</p> <p>PC12: Seek guidance and advice to support the design work</p> <p>PC13: Protect the designs as intellectual property in line with organisational policies and procedures</p> <p>PC14: Design and update records management and documentation systems</p> <p>PC15: Comply with health and safety and other relevant regulations and guidelines</p>

Prototyping and testing	<p>To be competent, the individual must be able to:</p> <p>PC16: Develop and test new products and prototypes</p> <p>PC17: Make the required modifications to the product according to the test results</p> <p>PC18: Prepare a test report on the results with recommendations for the manufacture of the tested product</p> <p>PC19: Work safely at all times, complying with health and safety and other relevant regulations and guidelines</p>
Process design	<p>To be competent, the individual must be able to:</p> <p>PC20: Lead on making improvements to processes and procedures</p> <p>PC21: Design suitable product processes with clear flow diagrams, technical data and other information</p> <p>PC22: Utilise customer requirements and the design specification for new process or processes</p> <p>PC23: Recommend improvements to existing or new manufacturing processes</p> <p>PC24: Monitor machine performance and capacity utilisation in order to determine and optimise timelines</p> <p>PC25: Work safely at all times, complying with health and safety and other relevant regulations and guidelines</p>
Conducting Experiments	<p>To be competent, the individual must be able to:</p> <p>PC26: Design an experiment</p> <p>PC27: Analyse the data</p> <p>PC28: Interpret the data</p>
Knowledge and Understanding (K)	
A. Organisational Context (Knowledge of the company/ organisation and its processes)	<p>The individual on the job must demonstrate knowledge and understanding of:</p> <p>OK1. Legislation, regulations, policies, standards, and procedures followed in the company relevant to own employment and performance conditions</p> <p>OK2. Organisational culture, vision and mission</p> <p>OK3. Typical customer profile</p> <p>OK4. Company's service level agreements and policies</p> <p>OK5. Company's code of conduct</p> <p>OK6. Organisation pricing and discount policy</p> <p>OK7. Organisation policy on documentation, reporting, etc.</p>
B. Technical Knowledge	<p>The individual on the job must demonstrate knowledge and understanding of:</p> <p>TK1. Sketching and design tools and methods</p> <p>TK2: Selection of suitable design software/package and the factors that must be considered</p> <p>TK3: How to prepare the design brief/specification and the different types of design briefs that could be required</p> <p>TK4: How to address any variations from the design brief</p> <p>TK5: Types and level of detail to be included in a design</p> <p>TK6: Approaches in attaining different types of designs</p> <p>TK7: Design formats that are most suitable to meet specific needs</p>

	<p>TK8: The minimum number of different designs that are necessary to provide a client/company with options</p> <p>TK9: How to present designs to the client/supervisor</p> <p>TK10: Standard practices for prototyping, testing methods and tools</p> <p>TK11: Production processes and technologies</p> <p>TK12. Intellectual property rights and protection</p> <p>TK13: Installation techniques and procedures</p> <p>TK14. Maintenance techniques and procedures</p> <p>TK15: Types of materials, material selection and treatment</p> <p>TK16: Obtaining information on regulations, standards, procedures, etc.</p> <p>TK17: Obtaining and interpreting drawings, charts, specifications and documents</p> <p>TK18: Preparation of bills of materials, product costing and Budgeting</p>
<p>C. Regulatory context (Knowledge of Rules and Regulations)</p>	<p>The individual on the job must demonstrate knowledge and understanding of:</p> <p>RK1. Applicable national laws regulating the engineering profession</p> <p>RK2: National laws regulating the manufacturing industry;</p> <p>RK3: Environmental Management Act No. 12 of 2011</p> <p>RK4: Occupational Health and Safety Act 36 of 2010</p> <p>RK5. Other applicable National and International Standards</p>
<p>Skills (S)</p>	
<p>A. Core Skills/ Generic Skills</p>	<p>Writing Skills</p>
	<p>The individual on the job must be able to:</p> <p>CS1. Write in English and give simple concise instructions.</p>
	<p>Reading Skills</p>
	<p>The individual on the job must be able to:</p> <p>CS2. Read and interpret internal/external documents.</p> <p>CS3. Read and understand manuals, health and safety instructions, memos, other company documents.</p> <p>CS4. Read from different sources- books, screens in machines and signage.</p> <p>CS5. Understand the various colour codes, nomenclature and acronyms related to the profession.</p>
<p>B. Professional Skills</p>	<p>Oral Communication (Listening and Speaking skills)</p>
	<p>The individual on the job must be able to :</p> <p>CS6. Express statements or information clearly so that others can hear and understand.</p> <p>CS7. Participate in and understand the main points of simple discussions.</p> <p>CS8. Respond appropriately to any queries.</p>
<p>B. Professional Skills</p>	<p>Decision Making</p>
	<p>The individual on the job must be able to:</p> <p>PS1. Follow organization rule-based decision-making process.</p> <p>PS2. Take decision with systematic course of actions and/or response.</p>

	Plan and Organise
	The individual on the job must be able to: PS3. Plan and organise work to meet deadlines. PS4. Work constructively and collaboratively with others.
	Customer Centricity
	The individual on the job must be able to: PS5. Follow code of conduct. PS6. Manage relationships with customers with intent on satisfying its requirements for service delivery. .
	Problem Solving and Decision Making
	The individual on the job must be able to: PS7. Recognize problems and search for solutions. PS8. Choose best methods to complete assigned tasks. PS9. Approach relevant authority when required. PS10. Judiciously use common sense in day to day activities
	Analytical Thinking
	The individual on the job must be able to: PS11. Apply domain knowledge, observations and data to select course of action to perform tasks
Critical Thinking	
The individual on the job must be able to: PS12. Critically evaluate information obtained from customers, supervisor and co-workers to perform day to day activities. PS13. Ask relevant questions for better understanding.	

UNIT 2 [This Unit is about implementing and monitoring compliance to occupational health and safety standards and regulations].

Unit No.	02
Unit Title	Implement and monitor occupational health and safety standards and regulations
Description	This unit is about demonstrating competence to implement and monitor compliance to occupational health and safety standards and regulations
Scope	This unit covers the following: <ul style="list-style-type: none"> • Planning • Implementing occupational health and safety standards and regulations • Monitoring compliance to occupational health and safety standards and regulations
Performance Criteria (PC) w.r.t. the Scope	
Element	Performance Criteria (PC)

<p>Planning</p>	<p>To be competent, the individual must be able to:</p> <ul style="list-style-type: none"> PC1: Interpret occupational health and safety regulations and standards PC2: Determine types of occupational health and safety information requirements PC3: Determine types of occupational health and safety equipment requirements PC4: Source appropriate occupational health and safety information PC5: Source appropriate occupational health and safety equipment PC6: Assess staff training needs in occupational health and safety PC7: Prepare or organise suitable training for staff PC8: Work safely at all times, complying with health and safety and other relevant regulations and guidelines
<p>Implementing occupational health and safety standards and regulations</p>	<p>To be competent, the individual must be able to:</p> <ul style="list-style-type: none"> PC9: Provide comprehensive staff induction programme PC10: Apply appropriate health and safety precautions, regulations and standards PC11: Review implementation of occupational health and safety standards and regulations PC12: Work safely at all times, complying with health and safety and other relevant regulations and guidelines
<p>Monitoring compliance to occupational health and safety standards and regulations</p>	<p>To be competent, the individual must be able to:</p> <ul style="list-style-type: none"> PC13: Regularly and systematically monitor compliance to occupational health and safety, e.g. importance of staff wearing protective clothing and other appropriate safety equipment PC14: Record and document and evaluate data on regulatory compliance to health and safety regulations and standards PC15: Work safely at all times, complying with health and safety and other relevant regulations and guidelines
<p>Knowledge and Understanding (K)</p>	
<p>A. Organisational Context (Knowledge of the company/organisation and its processes)</p>	<p>The individual on the job must demonstrate knowledge and understanding of:</p> <ul style="list-style-type: none"> OK1: Legislation, standards, policies, and procedures followed in the company OK2: Company policy pertaining to manufactured components OK3: Organisation culture and typical customer profile OK4: Company's service level agreements and policies OK5: Company's code of conduct OK6: Organisation pricing and discount policy OK7: Organisational policy on waste disposal and management OK8: Organisation policy on documentation, reporting, etc.

<p>B. Technical Knowledge</p>	<p>The individual on the job must demonstrate knowledge and understanding of:</p> <ul style="list-style-type: none"> TK1. Occupational health and safety regulations, standards and guidelines TK2. Key health and safety equipment required for the facility, e.g. fire extinguishers, water hydrants, first aid box, etc. TK3. Imparting knowledge to others TK4: Safety equipment/technique to use for specific types of hazards/risks TK5: Application of first aid
<p>C. Regulatory context (Knowledge of Rules and Regulations)</p>	<p>The individual on the job must demonstrate knowledge and understanding of:</p> <ul style="list-style-type: none"> RK1. Applicable national laws regulating the engineering profession RK2: National laws regulating the manufacturing industry RK3: Environmental Management Act No 12 of 2011 RK4: Occupational Health and Safety Act 36 of 2010 RK5. Other applicable National and International Standards
<p>Skills (S)</p>	
<p>A. Core Skills/ Generic Skills</p>	<p>Reading Skills</p>
	<p>The individual on the job must be able to:</p> <ul style="list-style-type: none"> CS1. Read and analyse the available data about the occupational health and safety; CS2: Read, interpret and adhere to safety precautions displayed on machines and equipment ketches and drawings CS3: Read equipment manuals and process documents to understand operational hazards and risks. CS4. Read internal information on health and safety sent by supervisor/other teams
	<p>Writing Skills</p>
<p>The individual on the job must be able to:</p> <ul style="list-style-type: none"> CS5. Note down observations (if any) CS6. Prepare requisitions to procurement/stores on the requirement of health and safety materials, and equipment, etc. CS7: Note down and display emergency numbers in the work place CS8: Prepare training notes and presentations 	
<p>Oral Communication (Listening and Speaking skills)</p>	

	<p>The individual on the job must be able to:</p> <ul style="list-style-type: none"> CS9. Discuss task lists, schedules and activities CS10. Effectively communicate with superiors, colleagues, subordinates and regulators CS11. Attentively listen and comprehend the information given by various sources; CS12. Make presentations CS13. Delegate tasks to other staff
<p>B. Professional Skills</p>	<p>Plan and Organise</p>
	<p>The individual on the job must be able to:</p> <ul style="list-style-type: none"> PS1. Logically plan and organise the work order/schedule PS2. Organise all process, manuals so that sorting out/accessing information is easy; PS3: Collect and keep up to date records
	<p>Judgment and Critical Thinking</p>
	<p>The individual on the job must be able to:</p> <ul style="list-style-type: none"> PS4. Use common sense and make judgments in day to day activities PS5. Use reasoning skills to identify and resolve basic problems PS6. Use intuition to detect any potential problems which could arise during operations
	<p>Desire to Learn and Take Initiatives</p>
	<p>The individual on the job must be able to:</p> <ul style="list-style-type: none"> PS7. Follow instructions and work on areas of improvement identified PS8. Complete assigned tasks with minimum supervision PS9. Complete jobs within timelines and budget and quality norms PS10. Be open to other ideas and information PS11. Keep up-to-date with latest trends and changes in industry and the profession
	<p>Problem Solving and Decision Making</p>
<p>The individual on the job must be able to:</p> <ul style="list-style-type: none"> PS12. Detect problems in day to day tasks PS13. Discuss possible solutions to address problems with subordinates and the supervisor PS14. Make decisions in emergency situations in the absence of the supervisor (as per the authority matrix defined by the organisation) 	

UNIT 3 [This Unit is about supervision and management of technical staff; artisans, technicians, technologists and other engineers].

Unit No.	03
Unit Title	People management
Description	This unit is about demonstrating competence to supervise and manage artisans, technicians, technologists and other engineers.
Scope	This unit covers the following: <ul style="list-style-type: none"> • Skills needs assessment • Job allocation • Supervision and performance management
Performance Criteria (PC) w.r.t. the Scope	
Element	Performance Criteria (PC)
Skills needs assessment	To be competent, the individual must be able to: PC1: Carry out a comprehensive staff induction programme PC2: Carry out a skills audit of staff, PC3: Identify and recommend appropriate training for staff
Job allocation	To be competent, the individual must be able to: PC4: Allocate jobs according to staff abilities PC5: Assemble task teams around highly skilled staff and facilitate team work PC6: Accommodate ideas from both subordinates and superiors.
Supervision and performance management	To be competent, the individual must be able to: PC7: Supervise and manage subordinates; PC8: Provide timely feedback to superiors and subordinates PC9: Carry out activities in the specified sequence and in an agreed timescale PC10.Coach and mentor subordinates PC11.Motivate and provide incentives for outstanding performance.
Knowledge and Understanding (K)	
A. Organisational Context (Knowledge of the company/ organisation and its processes)	The individual on the job must demonstrate knowledge and understanding of: OK1: Legislation, standards, policies, and procedures followed in the company OK2: Company policy pertaining to manufactured components OK3. Organisation culture and typical customer profile OK4. Company's service level agreements and policies OK5. Company's code of conduct OK6. Organisation pricing, discount policy OK7: Organisational policy on waste disposal and management OK8. Organisation policy on documentation, reporting, etc.

<p>B. Technical Knowledge</p>	<p>The individual on the job must demonstrate knowledge and understanding of:</p> <ul style="list-style-type: none"> TK1. Serving as a reliable link between subordinates and management TK2: Team work and staff motivation TK3: Staff welfare TK4. Importance of health and safety of staff under his/her supervision TK5: Need to impart knowledge to others
<p>C. Regulatory context (Knowledge of Rules and Regulations)</p>	<p>The individual on the job must demonstrate knowledge and understanding of:</p> <ul style="list-style-type: none"> RK1. Applicable national laws regulating the engineering profession RK2: National laws regulating the manufacturing industry; RK3: Environmental Management Act No 12 of 2011 RK4: Occupational Health and Safety Act 36 of 2010 RK5. Other applicable National and International Standards
<p>Skills (S)</p>	
<p>A. Core Skills/ Generic Skills</p>	<p>Reading Skills</p> <p>The individual on the job must be able to:</p> <ul style="list-style-type: none"> CS1. Read and analyse the available data about staff skills and qualifications CS2: Read and interpret conditions of service CS3: Read and interpret code of conduct CS4. Read internal information sent by supervisor/other teams <p>Writing Skills</p> <p>The individual on the job must be able to:</p> <ul style="list-style-type: none"> CS5. Note down observations (if any) CS6. Prepare work instructions CS7: Prepare training notes and presentations CS8: Prepare reports <p>Oral Communication (Listening and Speaking skills)</p> <p>The individual on the job must be able to:</p> <ul style="list-style-type: none"> CS9. Discuss task lists, schedules and activities CS10. Effectively communicate with superiors, colleagues, subordinates and regulators CS11. Attentively listen and comprehend the information given by various sources CS12. Make presentations CS13. Delegate tasks to other staff
<p>B. Professional Skills</p>	<p>Plan and Organise</p> <p>The individual on the job must be able to:</p> <ul style="list-style-type: none"> PS1. Logically plan and organise the work order/schedule and flow and jobs PS2. Organise all process, manuals so that sorting out/accessing information is easy PS3: Collect and keep-up-to date records

	Judgment and Critical Thinking
	The individual on the job must be able to: PS4. Use common sense and make judgments in day to day activities PS5. Use reasoning skills to identify and resolve basic problems PS6. Use intuition to detect any potential problems which could arise during operations
	Desire to Learn and Take Initiatives
	The individual on the job must be able to: PS7. Follow instructions and work on areas of improvement identified PS8. Complete assigned tasks with minimum supervision
	PS9. Complete jobs within timelines and budget and quality norms PS10. Be open to other ideas and information PS11. Keep up-to-date with latest trends and changes in industry and the profession.
	Problem Solving and Decision Making
	The individual on the job must be able to: PS12. Detect problems in day to day tasks PS13. discuss possible solutions to address problems with subordinates and the supervisor PS14. Make decisions in emergency situations in the absence of the supervisor (as per the authority matrix defined by the organisation)

UNIT 4 [This Unit is about Designing and Testing of Renewable energy systems].

Unit No.	04
Unit Title	Designing and Testing of Renewable energy Systems
Description	This unit is about designing and testing of Renewable energy systems.
Scope	This unit covers the following: <ul style="list-style-type: none"> • Sketching and designing of renewable energy systems • Process Design
Performance Criteria (PC) w.r.t. the Scope	
Element	Performance Criteria (PC)
Sketching and designing of renewable energy systems	To be competent, the individual must be able to: PC1: Conduct pre-design activities PC2: Design small scale renewable energy systems PC3: Generate designs that conform to client/market requirements PC4: Create a number of designs for client to choose from PC5: Organise the designs into suitable formats and with sufficient information to allow the client/superior to assess them

	<p>PC6: Justify any variations from the design brief and give a suitable reason for them</p> <p>PC7: Diagnose faults and analyse engineering problems</p> <p>PC8: Provide design engineering solutions (sketch and design new products)</p> <p>PC9: Prepare work schedules and plans</p> <p>PC10: Prepare and maintain section/departmental staff competency skills matrix</p> <p>PC11: Ensure that the designs comply with all relevant regulations, standards directives or codes of practice</p> <p>PC12: Seek guidance and advice to support the design work</p> <p>PC13: Protect the designs as intellectual property in line with organisational policies and procedures</p> <p>PC14: Design and update records management and documentation systems</p> <p>PC15: Comply with health and safety and other relevant regulations and guidelines</p>
Process design	<p>To be competent, the individual must be able to:</p> <p>PC16: Lead on making improvements to processes and procedures</p> <p>PC17: Design suitable product processes with clear flow diagrams, technical data and other information</p> <p>PC18: Utilise customer requirements and the design specification for new process or processes</p> <p>PC19: Recommend improvements to existing or new Renewables energy systems</p> <p>PC20: Monitor machine performance and capacity utilisation in order to determine and optimise timelines</p> <p>PC21: Work safely at all times, complying with health and safety and other relevant regulations and guidelines</p>
Knowledge and Understanding (K)	
A. Organisational Context (Knowledge of the company/organisation and its processes)	<p>The individual on the job must demonstrate knowledge and understanding of:</p> <p>OK1. Legislation, regulations, policies, standards, and procedures followed in the company relevant to own employment and performance conditions</p> <p>OK2. Organisational culture, vision and mission</p> <p>OK3. Typical customer profile</p> <p>OK4. Company's service level agreements and policies</p> <p>OK5. Company's code of conduct</p> <p>OK6. Organisation pricing and discount policy</p> <p>OK7. Organisation policy on documentation, reporting, etc.</p>
B. Technical Knowledge	<p>The individual on the job must demonstrate knowledge and understanding of:</p> <p>TK1. Sketching and design tools and methods</p> <p>TK2: Selection of suitable design software/package and the factors that must be considered</p> <p>TK3: Preparation of the design brief/specification and the different types of design briefs that could be required</p> <p>TK4: Dealing with any variations from the design brief</p>

	<p>TK5: Types and level of detail to be included in a design TK6: Approaches in attaining different types of designs TK7: Design formats that are most suitable to meet specific needs TK8: The minimum number of different designs that are necessary to provide a client/company with options TK9: Presentation of designs to the client/supervisor TK10: Principles of renewable energy and prospects of renewable energy sources TK11: Designing small-scale hydro power stations TK12: Designing biogas plants TK13: Solar energy conversion systems TK14: Wind energy conversion system TK15: Biomass conversion systems TK16: Installation techniques and procedures TK17: Maintenance techniques and procedures TK18: Types of materials, material selection and treatment TK19: Obtaining information on regulations, standards, procedures, etc. TK20: Obtaining and interpret drawings, charts, specifications and documents TK21: Preparation of bills of materials, product costing and budgeting</p>
<p>C. Regulatory context (Knowledge of Rules and Regulations)</p>	<p>The individual on the job must demonstrate knowledge and understanding of: RK1. Applicable national laws regulating the engineering profession RK2: National laws regulating the manufacturing industry; RK3: Environmental Management Act No. 12 of 2011 RK4: Occupational Health and Safety Act 36 of 2010 RK5. Other applicable National and International Standards</p>
<p>Skills (S)</p>	
<p>A. Core Skills/ Generic Skills</p>	<p>Writing Skills</p>
	<p>The individual on the job must be able to: CS1. Write in English and give simple concise instructions.</p>
	<p>Reading Skills</p>
	<p>The individual on the job must be able to: CS2. Read and interpret internal/external documents. CS3. Read and understand manuals, health and safety instructions, memos, other company documents. CS4. Read from different sources- books, screens in machines and signage. CS5. Understand the various colour codes, nomenclature and acronyms related to the profession.</p>
<p>Oral Communication (Listening and Speaking skills)</p>	
<p>The individual on the job must be able to : CS6. Express statements or information clearly so that others can hear and understand. CS7. Participate in and understand the main points of simple discussions.</p>	

	CS8. Respond appropriately to any queries.
B. Professional Skills	Decision Making
	The individual on the job must be able to: PS1. Follow organization rule-based decision-making process. PS2. Take decision with systematic course of actions and/or response.
	Plan and Organise
	The individual on the job must be able to: PS3. Plan and organise work to meet deadlines. PS4. Work constructively and collaboratively with others.
	Customer Centricity
	The individual on the job must be able to: PS5. Follow code of conduct. PS6. Manage relationships with customers with intent on satisfying its requirements for service delivery. .
	Problem Solving and Decision Making
	The individual on the job must be able to: PS7 Recognize problems and search for solutions. PS8. Choose best methods to complete assigned tasks. PS9. Approach relevant authority when required. PS10. Judiciously use common sense in day to day activities
	Analytical Thinking
	The individual on the job must be able to: PS11. Apply domain knowledge, observations and data to select course of action to perform tasks
Critical Thinking	
The individual on the job must be able to: PS12. Critically evaluate information obtained from customers, supervisor and co-workers to perform day to day activities. PS13. Ask relevant questions for better understanding.	

UNIT 5 [This unit is about undertaking entrepreneurship activities].

Unit No.	05
Unit Title	Undertake entrepreneurship activities
Description	This unit is about undertaking entrepreneurship activities required for setting up business
Scope	This unit/task covers the following: <ul style="list-style-type: none"> Undertake entrepreneurship activities
Performance Criteria (PC) w.r.t. the Scope	
Element	Performance Criteria (PC)
Undertake entrepreneurship activities	<p>To be competent, the individual must be able to:</p> <p>PC1. Conduct market survey and analyze market demand based on market trend, existing competition, current requirement, market status, etc.</p> <p>PC2. Identify possible sources of finance/loan</p> <p>PC3. Identify potential customers and maintain customer database</p> <p>PC4. Conduct target market assessment and decide positioning of products/services which is easily accessible to potential buyers</p> <p>PC5. Identify suitable location for ease of conducting business</p> <p>PC6. Identify and lead a team for management of business</p> <p>PC7. Ensure compliance with all government laws, local state laws and other regulations as maybe applicable</p> <p>PC8. Interact with successful entrepreneurs and business people in a similar field to gain expertise</p> <p>PC9. Identify distribution and marketing channels considering the requirements and constraints associated with the same</p> <p>PC10. Set a pricing strategy for the product/service based on the value of the product and modify pricing as and when required</p> <p>PC11. Conduct risk assessment and identify opportunities for scaling up the business</p> <p>PC12. Collect information related to various subsidies/funds/ schemes offered by the government, authorized state units and other financial institutions</p> <p>PC13. Track and maintain records, and monitor them on a regular basis</p> <p>PC14. Develop and execute promotional strategies for the business based on the budget and target segment</p> <p>PC15. Implement processes which help in minimizing costs and maximizing profits</p>
Knowledge and Understanding (K)	

A. Organisation -al Context (Knowledge of the company/ organisation and its processes)	<p>The individual on the job needs to know and understand:</p> <p>OK1. Agriculture sub sector (demand, supply, current trends, growth opportunities, challenges)</p> <p>OK2. Customer needs and demands</p> <p>OK3. How to network with experts and people in related field</p> <p>OK4. Documentation and related procedures</p>
B. Technical Knowledge	<p>The individual on the job must demonstrate knowledge and understanding of:</p> <p>TK1. Types of entrepreneur skills – communication, management, technical, financial, people related, etc.</p> <p>TK2. Executing business activities related to the entire value chain of business</p> <p>TK3. Team management practices</p> <p>TK4. Key leadership practices</p>
C. Regulatory context (Knowledge of Rules and Regulations)	<p>The individual on the job must demonstrate knowledge and understanding of:</p> <p>RK1. Applicable national laws regulating the engineering profession</p> <p>RK2: National laws regulating the manufacturing industry</p> <p>RK3: Environmental Management Act No 12 of 2011</p> <p>RK4: Occupational Health and Safety Act 36 of 2010</p> <p>RK5. Other applicable National and International Standards</p>
Skills (S)	
A. Core Skills/ Generic Skills	Writing Skills
	<p>The individual on the job must be able to:</p> <p>CS1. Select the information to be communicated</p> <p>CS2. Complete relevant applications and documents</p> <p>CS3. Select the information required for establishing the unit</p> <p>CS4. Document necessary process and process equipments</p> <p>CS5. Interact with government officials, financial institutions and workers.</p>
	Reading Skills
	<p>The individual on the job must be able to:</p> <p>CS6. Read and interpret internal/external documents.</p> <p>CS7. Read and understand manuals, health and safety instructions, memos, other company documents.</p> <p>CS8. Read from different sources- books, screens in machines and signage.</p> <p>CS9. Understand the various colour codes, nomenclature and acronyms related to the profession.</p>
Oral Communication (Listening and Speaking skills)	
<p>The individual on the job must be able to :</p> <p>CS10. Express statements or information clearly so that others can hear and understand.</p> <p>CS11. Participate in and understand the main points of simple discussions.</p> <p>CS12. Respond appropriately to any queries.</p>	
	Decision Making

B. Professional Skills	The individual on the job must be able to: PS1. Follow organization rule-based decision-making process. PS2. Take decision with systematic course of actions and/or response.
	Plan and Organise
	The individual on the job must be able to: PS3. Plan and organise work to meet deadlines. PS4. Work constructively and collaboratively with others.
	Customer Centricity
	The individual on the job must be able to: PS5. Follow code of conduct. PS6. Manage relationships with customers with intent on satisfying its requirements for service delivery.
	Problem Solving and Decision Making
	The individual on the job must be able to: PS7. Recognize problems and search for solutions. PS8. Choose best methods to complete assigned tasks. PS9. Approach relevant authority when required. PS10. Judiciously use common sense in day to day activities
	Analytical Thinking
The individual on the job must be able to: PS11. Apply domain knowledge, observations and data to select course of action to perform tasks	
Critical Thinking	
The individual on the job must be able to: PS12. Critically evaluate information obtained from customers, supervisor and co-workers to perform day to day activities. PS13. Ask relevant questions for better understanding.	

UNIT 6 [This unit is about carrying out design, installation and maintenance of irrigation system]

Unit No.	06
Unit Title	Design and installation of irrigation system
Description	This unit is about carrying out design, installation and maintenance of irrigation system
Scope	This unit/task covers the following: <ul style="list-style-type: none"> Carry out installation and commissioning of irrigation and drainage pump sets Design of irrigation systems
Performance Criteria (PC) w.r.t. the Scope	
Element	Performance Criteria (PC)
Carry out installation and commissioning of irrigation and drainage pump sets	To be competent, the individual must be able to: <p>PC1. Check method to be used for irrigation-furrow irrigation, basic irrigation, surface irrigation, etc.</p> <p>PC2. Select the pump to match the power output: <ul style="list-style-type: none"> submersible pump indigenous pump solar pump centrifugal pump </p> <p>PC3. Lay the foundation and set foundation bolts</p> <p>PC4. Check the distance at the time of installation for pipe, foot valve selection</p> <p>PC5. Mount pumps and accessories such as foot valve, pipes, bends, elbow, etc.</p> <p>PC6. Ensure mechanical coupling between the prime mover and pump</p> <p>PC7. Check the alignment of the coupling</p> <p>PC8. Provide three phase/ single phase electrical connections to the power engine</p> <p>PC9. Fit starter and other electrical accessories</p> <p>PC10. Carry out commissioning and testing of pump</p>
Design of irrigation systems	To be competent, the user/individual must be able to: <p>PC11. Design surface irrigation systems</p> <p>PC12. Design pressurised irrigation systems</p> <p>PC13. Design Sub-surface irrigation systems</p> <p>PC14. Design surface and sub – surface drainage systems</p> <p>PC15. Design channels for water conveyance, lined and unlined canals</p> <p>PC16. Design water storage structures (dams and water reservoirs)</p>
Knowledge and Understanding (K)	

A. Organisational Context (Knowledge of the company/organisation and its processes)	<p>To be competent, the individual on the job needs to know and understand:</p> <ul style="list-style-type: none"> OK1. Code of business conduct OK2. Job responsibilities and duties OK3. Standard operating procedures for usage of pumps and pump sets OK4. Safety and precautions to be undertaken while operating irrigation systems
B. Technical Knowledge	<p>To be competent, the individual on the job needs to know and understand:</p> <ul style="list-style-type: none"> TK1. Selection of pipes, and pipe fittings for irrigation systems TK2. Operation, repair and periodical maintenance of various pumps (submersible, indigenous, solar, centrifugal) and their motors TK3. Working principle of single cylinder diesel engine TK4. Components of pressurised irrigation system TK5. Standard practices of pumping systems TK6. Appropriate material for construction of water storage structures TK7. Installation of different types of pumps TK8. Different types of couplings between pumps and prime movers TK9. Electrical installations and electrical connections TK10. Water requirements and factors in scheduling KT11. Farm ponds and hydraulic structures KT12. Pumps and irrigation pumping plants KT13. Sprinkler irrigation systems KT14. Trickle (Drip) irrigation systems KT15. Surface irrigation systems KT16. Agricultural land drainage KT17. Evaluating irrigation projects KT18. Crop water requirements
C. Regulatory context (Knowledge of Rules and Regulations)	<p>To be competent, the individual on the job must demonstrate knowledge and understanding of:</p> <ul style="list-style-type: none"> RK1. Applicable laws regulating the engineering profession RK2: National laws regulating the manufacturing industry RK3: Environmental Management Act No 12 of 2011 RK4: Occupational Health and Safety Act 36 of 2010 RK5. Other applicable National and International Standards
Skills (S)	
A. Core Skills/ Generic Skills	<p style="background-color: #fce4d6;">Writing Skills</p> <p>The individual on the job must be able to:</p> <ul style="list-style-type: none"> CS1. Select the information to be communicated CS2. Complete relevant applications and documents CS3. Compile information required for establishing the unit CS4. Document necessary process and process equipment CS5. Interact with government officials, financial institutions and workers.

	Reading Skills
	The individual on the job must be able to: CS6. Read and interpret internal/external documents. CS7. Read and understand manuals, health and safety instructions, memos, other company documents. CS8. Read from different sources- books, screens in machines and signage. CS9. Understand the various colour codes, nomenclature and acronyms related to the profession.
	Oral Communication (Listening and Speaking skills)
	To be competent, the individual on the job must be able to : CS10. Express statements or information clearly so that others can hear and understand. CS11. Participate in and understand the main points of simple discussions. CS12. Respond appropriately to any queries.
A. Professional Skills	Decision Making
	The individual on the job must be able to: PS1. Follow organization rule-based decision-making process. PS2. Take decision with systematic course of actions and/or response.
	Plan and Organise
	The individual on the job must be able to: PS3. Plan and organise work to meet deadlines. PS4. Work constructively and collaboratively with others.
	Customer Centricity
	The individual on the job must be able to: PS5. Follow code of conduct. PS6. Manage relationships with customers with intent on satisfying its requirements for service delivery. .
	Problem Solving and Decision Making
	The individual on the job must be able to: PS7. Recognize problems and search for solutions. PS8. Choose best methods to complete assigned tasks. PS9. Approach relevant authority when required. PS10. Judiciously use common sense in day to day activities
	Analytical Thinking
	The individual on the job must be able to: PS11. Apply domain knowledge, observations and data to select course of action to perform tasks
Critical Thinking	
The individual on the job must be able to: PS12. Critically evaluate information obtained from customers, supervisor and co-workers to perform day to day activities. PS13. Ask relevant questions for better understanding.	

UNIT 7 [This Unit is about Agricultural Mechanisation for Food Production].

Unit No.	07
Unit Title	Agricultural Mechanisation for Food Production
Description	This unit is about Agricultural Mechanisation for Arable Crop and livestock Production
Scope	This unit covers the following: <ul style="list-style-type: none"> • Machinery for Crop Production • Agricultural Machinery Management.
Performance Criteria (PC) w.r.t. the Scope	
Element	Performance Criteria (PC)
Machinery for Crop Production	To be competent, the individual must be able to: PC1: Match equipment with the power source PC2: Demonstrate the proper application of Land Clearing and Levelling equipment PC3: Demonstrate the proper application of Seedbed Preparation equipment PC4: Demonstrate the proper application of Crop Planting equipment PC5: Demonstrate the proper application of Fertilizer Handling and Application equipment PC6: Demonstrate the proper application of Crop Protection equipment PC7: Demonstrate the proper application of Agricultural Crops Harvesting equipment PC8: Demonstrate the proper application of livestock equipment. PC9: Demonstrate the proper application of Precision Farming:
Agricultural Machinery Management.	To be competent, the individual must be able to: PC10: Determine Agricultural Machinery Performance PC11: Cost Agricultural Operations PC12: Optimise the use of agricultural machinery PC13: Determine the performance of agricultural machinery PC14: Select appropriate implements and machines for field operations involved in crop production. PC15: Select appropriate implements and machines for field operations involved in Livestock production PC16: Properly adjust farm implements and machines for prevailing field conditions. PC17: Determine the cost of carrying out each field operation. PC18: Evaluate farm machinery
Knowledge and Understanding (K)	

<p>A. Organisational Context (Knowledge of the company/organisation and its processes)</p>	<p>The individual on the job must demonstrate knowledge and understanding of:</p> <ul style="list-style-type: none"> OK1. Legislation, regulations, policies, standards, and procedures followed in the company relevant to own employment and performance conditions OK2. Organisational culture, vision and mission OK3. Typical customer profile OK4. Company's service level agreements and policies OK5. Company's code of conduct OK6. Organisation pricing and discount policy OK7. Organisation policy on documentation, reporting, etc.
<p>B. Technical Knowledge</p>	<p>The individual on the job must demonstrate knowledge and understanding of:</p> <ul style="list-style-type: none"> TK1: Agricultural Mechanization TK2: Land Clearing and Levelling, the Methods, tools and machinery used TK3: Seedbed Preparation and the Implements used for primary and secondary tillage operations TK4: Crop Planting Objectives for crop planting, Planting machinery and its calibration TK5: Fertilizer Handling and Application including Machinery for handling and applying fertilizers TK6: Crop Protection including Alternative Pest Control methods, Integrated Pest Management (IPM), and Equipment for chemical application with emphasis on sprayers TK7: Harvesting of Agricultural Crops including Methods, machinery and tools for harvesting crops and Principles of operation of combine harvesting, TK8: Precision Farming and Components of a Precision Farming System, Applications TK9: Agricultural Machinery Performance including Factors affecting machine capacity, Estimating capacity for field operations, TK10: Selecting the right size of agricultural implements TK11: Tractor Performance Prediction using Nebraska and Selection of power units for field operations, Field determination of wheel slip. TK12: Costing of Agricultural Operations including Field operation cost components, Total cost of carrying out field operations TK13: Machinery Financing Methods: Purchase with own cash, Bank Loan, Hire purchase, Leasing. TK14: Machinery Selection Methods including Minimum cost system, Break-even analysis, Partial Budgeting, Discounted Cash Flow TK 15: Animal husbandry and machinery applied to livestock.

<p>C. Regulatory context (Knowledge of Rules and Regulations)</p>	<p>The individual on the job must demonstrate knowledge and understanding of:</p> <ul style="list-style-type: none"> RK1. Applicable laws regulating the engineering profession RK2: National laws regulating the manufacturing industry; RK3: Legislation on Environmental Management RK4: Legislation on Occupational Health and Safety RK5. Other applicable National and International Standards
<p>Skills (S)</p>	
<p>A. Core Skills/ Generic Skills</p>	<p>Writing Skills</p>
	<p>The individual on the job must be able to:</p> <ul style="list-style-type: none"> CS1. Write in English and give simple concise instructions.
	<p>Reading Skills</p>
	<p>The individual on the job must be able to:</p> <ul style="list-style-type: none"> CS2. Read and interpret internal/external documents. CS3. Read and understand manuals, health and safety instructions, memos, other company documents. CS4. Read from different sources- books, screens in machines and signage. CS5. Understand the various colour codes, nomenclature and acronyms related to the profession.
<p>B. Professional Skills</p>	<p>Oral Communication (Listening and Speaking skills)</p>
	<p>The individual on the job must be able to :</p> <ul style="list-style-type: none"> CS6. Express statements or information clearly so that others can hear and understand. CS7. Participate in and understand the main points of simple discussions. CS8. Respond appropriately to any queries.
	<p>Decision Making</p>
	<p>The individual on the job must be able to:</p> <ul style="list-style-type: none"> PS1. Follow organization rule-based decision-making process. PS2. Take decision with systematic course of actions and/or response.
	<p>Plan and Organise</p>
	<p>The individual on the job must be able to:</p> <ul style="list-style-type: none"> PS3. Plan and organise work to meet deadlines. PS4. Work constructively and collaboratively with others.
<p>B. Professional Skills</p>	<p>Customer Centricity</p>
	<p>The individual on the job must be able to:</p> <ul style="list-style-type: none"> PS5. Follow code of conduct. PS6. Manage relationships with customers with intent on satisfying its requirements for service delivery.
	<p>Problem Solving and Decision Making</p>
	<p>The individual on the job must be able to:</p> <ul style="list-style-type: none"> PS7 Recognize problems and search for solutions. PS8. Choose best methods to complete assigned tasks. PS9. Approach relevant authority when required. PS10. Judiciously use common sense in day to day activities

	Analytical Thinking
	The individual on the job must be able to: PS11. Apply domain knowledge, observations and data to select course of action to perform tasks
	Critical Thinking
	The individual on the job must be able to: PS12. Critically evaluate information obtained from customers, supervisor and co-workers to perform day to day activities. PS13. Ask relevant questions for better understanding.

UNIT 8 [This Unit is about Food Process Engineering].

Unit No.	08
Unit Title	Food Process Engineering
Description	This unit is about Food Process Engineering
Scope	This unit covers the following: <ul style="list-style-type: none"> • Basic Principles of Food Process Engineering • Unit Operations of Food Engineering.
Performance Criteria (PC) w.r.t. the Scope	
Element	Performance Criteria (PC)
Basic Principles of Food Process Engineering	To be competent, the individual must be able to: PC1: Create models for material and energy balances in food processing operations.
Unit Operations of Food Engineering	PC2: Create process charts for operations in food engineering PC3: Select appropriate methods for preservation of foods. PC4: Design food processing equipment.
Knowledge and Understanding (K)	
A. Organisational Context (Knowledge of the company/ organisation and its processes)	The individual on the job must demonstrate knowledge and understanding of: <ul style="list-style-type: none"> OK1. Legislation, regulations, policies, standards, and procedures followed in the company relevant to own employment and performance conditions OK2. Organisational culture, vision and mission OK3. Typical customer profile OK4. Company's service level agreements and policies OK5. Company's code of conduct OK6. Organisation pricing and discount policy OK7. Organisation policy on documentation, reporting, etc.
B. Technical Knowledge	The individual on the job must demonstrate knowledge and understanding of: <ul style="list-style-type: none"> TK1: Conservation of mass, engineering process, dimensions and units, material and energy balances.

	<p>TK2: Pumps and fans: positive displacement pumps, jet pumps, air-lift pumps, propeller pumps and fans, centrifugal pumps and fans; pumps for the process industries; matching of pumps and pipelines.</p> <p>TK3: Heat transfer theory: heat conduction, surface heat transfer, unsteady heat transfer, radiation heat transfer, convection heat transfer, overall heat transfer coefficient, heat transfer from condensing vapours, heat transfer to boiling liquids.</p> <p>TK4: Heat transfer applications: heat exchangers, thermal processing, refrigeration, chilling and freezing.</p> <p>TK5: Drying: basic theory, mass transfer in drying, psychrometry, equilibrium moisture content, air drying, conduction drying, drying equipment, moisture loss in freezers and chillers.</p> <p>TK6: Evaporation: single-effect evaporator, multiple-effect evaporator, vapour compression, boiling-point elevation, evaporation of heat sensitive materials, evaporation equipment.</p> <p>TK7: Contact-equilibrium separation processes theory: concentrations, gas-liquid equilibrium, solid-liquid equilibrium, equilibrium-concentration relationships, operating conditions, calculation of separation in contact-equilibrium processes.</p> <p>TK8: Contact-equilibrium separation processes applications: gas absorption, extraction and washing, crystallization, membrane separations, distillation.</p> <p>TK9: Mechanical separations: velocity of particles moving in a fluid, sedimentation, centrifugal separations, filtration, sieving.</p> <p>TK10: Size reduction: Grinding and cutting, emulsification.</p> <p>TK11: Mixing: characteristics of mixtures, measurement of mixing, particle mixing, liquid mixing, and mixing equipment.</p> <p>TK12: Some engineering applications of process engineering in the food industry: meat industry, dairy industry</p>
<p>C. Regulatory context (Knowledge of Rules and Regulations)</p>	<p>The individual on the job must demonstrate knowledge and understanding of:</p> <p>RK1. Applicable national laws regulating the engineering profession</p> <p>RK2: National laws regulating the manufacturing industry;</p> <p>RK3: Environmental Management Act No. 12 of 2011</p> <p>RK4: Occupational Health and Safety Act 36 of 2010</p> <p>RK5. Other applicable National and International Standards</p>
<p>Skills (S)</p>	
<p>A. Core Skills/ Generic Skills</p>	<p>Writing Skills</p>
	<p>The individual on the job must be able to:</p> <p>CS1. Write in English and give simple concise instructions.</p>
	<p>Reading Skills</p>
<p>The individual on the job must be able to:</p>	

	<p>CS2. Read and interpret internal/external documents. CS3. Read and understand manuals, health and safety instructions, memos, other company documents. CS4. Read from different sources- books, screens in machines and signage. CS5. Interpret the various colour codes, nomenclature and acronyms related to the profession.</p>
	<p>Oral Communication (Listening and Speaking skills)</p>
	<p>The individual on the job must be able to :</p> <p>CS6. Express statements or information clearly so that others can hear and understand. CS7. Participate in and understand the main points of simple discussions. CS8. Respond appropriately to any queries.</p>
<p>B. Professional Skills</p>	<p>Decision Making</p>
	<p>The individual on the job must be able to:</p> <p>PS1. Follow organization rule-based decision-making process. PS2. Take decision with systematic course of actions and/or response.</p>
	<p>Plan and Organise</p>
	<p>The individual on the job must be able to:</p> <p>PS3. Plan and organise work to meet deadlines. PS4. Work constructively and collaboratively with others.</p>
	<p>Customer Centricity</p>
	<p>The individual on the job must be able to:</p> <p>PS5. Follow code of conduct. PS6. Manage relationships with customers with intent on satisfying its requirements for service delivery.</p>
	<p>Problem Solving and Decision Making</p>
	<p>The individual on the job must be able to:</p> <p>PS7. Recognize problems and search for solutions. PS8. Choose best methods to complete assigned tasks. PS9. Approach relevant authority when required. PS10. Judiciously use common sense in day to day activities</p>
	<p>Analytical Thinking</p>
	<p>The individual on the job must be able to:</p> <p>PS11. Apply domain knowledge, observations and data to select course of action to perform tasks</p>
	<p>Critical Thinking</p>
	<p>The individual on the job must be able to:</p> <p>PS12. Critically evaluate information obtained from customers, supervisor and co-workers to perform day to day activities. PS13. Ask relevant questions for better understanding.</p>

5. EQUIPMENT, TOOLS AND CONSUMABLE MATERIALS

Design and Prototyping equipment and tools, computer software applications, Machine shop equipment and tools, Fabrication shop equipment and tools, Electrical equipment, Maintenance equipment and tools, Testing equipment and tools, Personal protective equipment, etc.

6. DILEMMAS/CHALLENGES AND COMPLEXITIES FOR A JOB HOLDER

Agricultural Engineers face challenges such as obsolete and/or inappropriate equipment and tools, budgetary constraints, inadequate product costing skills, poor technical skill base, bureaucracy in procurement procedures, lack of appreciation of preventive maintenance by non-engineering management staff, labour intensive nature of the work, rapid change of technology and materials, lack of personal protective equipment, climate change, cyber warfare, inconsistency in company and government policies and regulations, etc.

6.1 Alternative Choices (Solutions) to Dilemmas and Complexities

Solutions to dilemmas include carrying out risk assessment and implementing appropriate control measures, ensuring good time management and planning, participating in workplace safety sensitization and awareness, supporting capacity building through training, managing work stress, adhering to company's safety and standard operating procedures at all times, paying attention to detail, consulting extensively within and outside one's department/team on safety and other issues.

7. WORKING CONDITIONS/ENVIRONMENT

Agricultural Engineers work with a variety of machinery, toxic substances and volatile materials, their work environment is susceptible to fires, explosions, structural failures and equipment malfunctions. Working conditions include cold, hot and wet conditions, climbing heights, stand/walk for long hours, lifting materials, working in day or night shifts, areas that are noisy and dusty, areas with limited lighting and ventilation, etc.

8. PARTIES INVOLVED/INTERACTING WITH THE JOB HOLDER OR TRAINEE

8.1 Internal/Within the Organization

Parties involved/interacting with the job holder who are internal to the organization include supervisors, subordinates, and other employees.

8.2 External/Outside the Organization

Parties involved/interacting with the job holder who are external include customers/clients, government regulators, trainers, suppliers of equipment/tools/consumables, occupational health and safety associations, Academia etc.

9. PHYSICAL DEMANDS ON THE BODY

- Physique to sustain strenuous conditions;
- Be able to walk and stand for long periods of time;
- Bend, stretch, twist, or reach out;
- Be able to lift relatively heavy materials, tools and equipment;
- Be able to use fingers, hands and feet with ease to complete the assigned task (dexterity);
- Etc.

ANNEX A

Criteria for Assessments based on this NOS

A.1 Guidelines for Assessment

A.1.1 Criteria for assessment for curricula and learning programmes based on this NOS will be created by curricula and programmes developers. Each Performance Criteria (PC) will be assigned marks proportional to its importance in the NOS. Curricula and programmes developers will also lay down proportion of marks for theory and practical skills for each performance criteria, giving more weight to practical skills.

There shall be allocated the 'Total Mark', which will be the sum of all marks in each Unit, distributed across the number of PCs in that particular Unit. The 'out of' mark will be the mark allocated to each PC, which will be shared between theory and skills practical assessments.

A.1.2 Awarding/assessment bodies or institutions and other users of the NOS will create unique question papers for the theory part and evaluations for skill practical part for their respective candidates.

ANNEX B NOS Version Control

This Annex gives details necessary for the tracking of the NOS versions based on the number of revisions.

NOS Code	NOS.AE.01		
ZQF Level	7	Version Number	01
Sector	Agriculture	Date of Approval	19 th May 2022
Sub Sector	Agricultural Engineering	Date of Last Review	N/A
Occupation	Agriculture Engineer	Date of Next Review	May 2027

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