REPUBLIC OF KENYA

COMPETENCY BASED MODULAR CURRICULUM

FOR

AGRICULTURAL ENGINEERING

KNQF LEVEL 6

(CYCLE 3)

PROGRAMME ISCED CODE: 0716 554 A

TVET CDACC
P.O. BOX 15745-00100
NAIROBI

ENGINEERING MATHEMATICS

UNIT CODE: 0716 541 16A

TVET CDACC UNIT CODE: ENG/CU/AGR/CC/01/6/MA

UNIT DURATION: 100 Hours

Relationship to Occupational Standards

This unit addresses the Unit of Competency**: Apply Engineering Mathematics**

Unit Description

This unit describes the competences required in order to apply engineering mathematics. It enables the learner to; Apply complex numbers, perform coordinate geometry, carry out binomial expansion, apply calculus, apply vector theorem and Apply matrices

Summary of Learning Outcomes

S/No.	Learning Outcomes	Duration (Hours)
1.	Apply complex numbers	10
2.	Perform coordinate geometry	10
3.	Carry out binomial expansion	20
4.	Apply calculus	40
5.	Apply vector theorem	10
6.	Apply matrices	10
TOTAL		**100**

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods

1. Apply complex numbers	1.1 Complex geometry
	    1.1.1 Real part
	    1.1.2 Imaginary part
	    1.1.3 Argand diagram
	    1.1.4 Modulus/Magnitude
	    1.1.5 Argument /Angle
		• Written tests

	1.1.6 Conjugate	
	1.2 Operations	
	1.2.1 Addition	
	1.2.2 Subtraction	
	1.2.3 Multiplication	
	1.2.4 Division	
	1.2.5 Conversions	
	1.2.5.1 Polar form to rectangular form	
	1.2.5.2 Rectangular form to polar form	
	1.3 De Moivre's theorem	
	1.3.1 Expansion of complex numbers	
	1.3.2 Roots of complex numbers	
	1.3.3 Trigonometric identities using complex numbers	
2. Perform coordinate geometry	2.1 Cartesian geometry	• Written tests
	2.1.1 Cartesian plane	
	2.1.1.1 x and y axes	
	2.1.1.2 Positive and negative coordinates	
	2.1.2 Gradient	
	2.1.2.1 Positive	
	2.1.2.2 Negative	
	2.1.2.3 Zero	
	2.1.2.4 Infinite	
	2.1.2.5 Gradients of parallel line	

	2.1.2.6 Gradients of perpendicular lines
	
	2.1.3 y-intercept
	
	2.2 Linear equations
	    2.2.1 Straight line
	    2.2.2 Parallel lines
	    2.2.3 Perpendicular lines
	
	2.3 Graphs of linear equations
	    2.3.1 Straight lines
	
	2.4 Polar geometry
	    2.4.1 Magnitude
	    2.4.2 Direction
	    2.4.3 Graphs
	
	2.5 Conversions
	    2.5.1 Linear to polar
	    2.5.2 Polar to linear
	
	2.6 Solving polar equations	

3. Carry out binomial expansion	3.1 Binomial series
	    3.1.1 Powers
	    3.1.2 Coefficients
	    3.1.3 Pascals triangle
	    3.1.4 Expansion
	
	3.2 Binomial theorem
	    3.2.1 Positive powers of n
	    3.2.2 Negative powers of n
	    3.2.3 Fractional powers of n (roots)
	    3.2.4 Estimation of errors of small changes
		• Written tests

4. Apply calculus	4.1 Differentiation up to third order 4.1.1 Functions	• Written tests

		4.1.1.1 Linear	
		4.1.1.2 Trigonometric	
		4.1.1.3 Logarithmic	
		4.1.1.4 Exponential	
		4.1.2 Rules	
		4.1.2.1 Power	
		4.1.2.2 Product	
		4.1.2.3 Chain	
		4.1.2.4 Quotient	
		4.1.3 Applications	
		4.1.3.1 Stationary points	
		4.1.3.2 Rates of change	
		4.2 Integration	
		4.2.1 Standard integral	
		4.2.2 Definite integral	
		4.2.3 Techniques	
		4.2.3.1 By parts	
		4.2.3.2 Substitution	
		4.2.3.3 Partial fractions	
		4.2.4 Applications	
		4.2.4.1 Area between and under curves	
		4.2.4.2 Volume	
		4.2.5 Differential equation	
		4.2.6 Double and triple integral	
		4.2.7 Laplace transform	
		4.2.8 Fourier series	
4	Apply vector theorem	4.2 Differentiate between vector and scalar quantities	• Written tests
		4.2.3 Magnitude	
		4.2.4 Direction	

		4.2.4.1 Positive	
		4.2.4.2 Negative	
		4.3 Operation on vectors	
		4.3.3 Addition	
		4.3.4 Subtraction	
		4.3.5 Dot product	
		4.3.6 Cross product	
		4.4 Resolution of vectors	
		4.4.3 Analysis	
		4.4.4 Graphical Methods	
		4.4.4.1 Triangle theorem	
		4.4.4.2 Parallel theorem	
		4.4.4.3 Polygon theorem	
5	Apply matrices	5.2 Matrices	• Written tests
		5.2.3 Types	
		5.2.3.1 Row	
		5.2.3.2 Column	
		5.2.3.3 Square	
		5.2.3.4 Zero	
		5.2.3.5 Identity	
		5.2.3.6 Diagonal	
		5.3 Matrices operations (up to 3 x 3)	
		5.3.3 Addition	
		5.3.4 Subtraction	
		5.3.5 Multiplication	
		5.4 Inverse of matrices (up to 3 x 3)	
		5.4.3 Determinant	
		5.4.4 Transpose	
		5.4.5 Adjoint	
		5.4.6 Inverse	
		5.5 Simultaneous equations	

		(up to 3 equations)	
		5.5.3 Inverse method	
		5.5.4 Crammers Rule	
		5.5.5 Row reduction	

Suggested Delivery Methods

- Demonstration

- Group discussions

- Online materials

- Direct instructions

- Simulation

Recommended Resources for 25 trainees

S/No.	Category/Item	Description/Specifications	Quantity	Recommended Ratio (Item: Trainee)
A	Learning Materials			
1.	Textbooks	Comprehensive textbooks on Engineering Mathematics	25	1:1
2.	Graph books	For graphical representation of solutions	25	1:1
3.	Projector	Functional projector for displaying content during presentations	1	1:25
4.	Computer	Functional desktop computer with online instructional content	1	1:25
5.	White board	Quality whiteboard of approximately 6 ft by 3 ft for writing during theory instruction	1	1:25
6.	Printer	An ink-jet, laser-jet or toner-cartridge printer for printing	1	1:25

		notes, instructions and working drawings		
7.	Training Presentations/Slides	Digital format for shared access among trainees	1	1:25
8.	Standard Mathematical Tables	For reference on formulae, identities, laws and principles	25	1:1
B	**Learning Facilities & Infrastructure**			
9.	Lecture/Theory Room	Spacious room with seats for 25 trainees, approximately 60 sqm	1	1:25
C	**Materials and Supplies**			
10.	First Aid kit	Fully equipped First Aid kit for use in case of accidents	1	1:25
11.	Brooms and cleaning stuff	Hand brooms and mops for cleaning	10	2:5
D	**Tools and Equipment**			
12.	Set of Mathematical instruments	For constructions and measurements	30	1:1
13.	Firefighting extinguishers	Water, carbon dioxide and chemical powder fire extinguishers for fire fighting	1	1:25