REPUBLIC OF KENYA

COMPETENCY BASED MODULAR CURRICULUM

FOR

ANALYTICAL CHEMISTRY TECHNOLOGY

KNQF LEVEL 6
(CYCLE 3) PROGRAMME ISCED CODE: 0531 554A

TVET CDACC
P.O. BOX 15745-00100 NAIROBI

MATHEMATICS FOR SCIENCE

ISCED UNIT CODE: 0541 551 03A

TVET CDACC UNIT CODE: ASC/CU/ACHEM/CC/01/6/MA

Relationship to Occupational Standards

This unit addresses the unit of competency: Apply Mathematics for Science.

Duration: 150 Hours

Unit Description

This unit describes the competencies required by a science laboratory technologist in order to apply mathematics for science. It involves applying: basic arithmetic operation; algebraic equation and expression; linear and non-linear graphs; indices and logarithm; binomial expansion; matrices; vectors; trigonometry; calculus; sequence and series and statistics,

Summary of Learning Outcomes

S/NO.	Learning Outcome	Duration (hours)
1.	Apply Basic arithmetic operations	**10**
2.	Apply Algebraic equation and expression	**15**
3.	Apply Indices and logarithms	**15**
4.	Apply Linear and nonlinear graphs	**10**
5.	Apply Binomial expansions	**15**
6.	Apply matrices	**15**
7.	Apply vectors	**10**
8.	Apply trigonometry	**15**

9.	Apply calculus	**20**
10.	Apply Sequence and series	**10**
11.	Apply statistics	**15**

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods

1. Apply basic arithmetic operation	1.1 Addition and subtraction on;
	    1.1.1 Natural numbers
	    1.1.2 Integers
	    1.1.3 Fractions
	    1.1.4 Decimals
	1.2 Multiplication and division on;
	    1.2.1 Natural numbers
	    1.2.2 Integers
	    1.2.3 Fractions
	    1.2.4 Decimals
	1.3 Rational and irrational numbers
	1.4 Ratios, proportions and percentages
	    1.4.1 Direct proportion
	    1.4.2 Inverse proportion
		• Observation
		• Third party report
		• Written tests
		• Oral questioning
		• Portfolio of evidence
		• Interviews

2. Apply algebraic equation and expression	2.1 Solution of linear equations
	2.2 Solution of simultaneous
	    2.2.1 Elimination method
	    2.2.2 Substitution method
	    2.2.3 Graphical method
	2.3 Transposition of formula
	2.4 Solution of quadratic equations
		• Observation
		• Written tests
		• Oral questioning
		• Portfolio of evidence
		• Interviews

	2.4.1 Factorization 2.4.2 Completing square method 2.4.3 Quadratic formula	
3. Apply linear and non-linear graphs	3.1 Linear and nonlinear graphs 3.2 Reduction of non-linear to linear graphs 3.3 Interpretation of graphs	• Observation • Written tests • Oral questioning • Portfolio of evidence • Interviews

4. Apply indices and logarithms	4.1 Indices
	   4.1.1 Bases
	   4.1.2 Laws of indices
	   4.1.3 Indicial equations
	4.2 Logarithms
	   4.2.1 Laws of logarithms
	   4.2.2 Logarithmic operations
	4.3 Conversion of base of logarithms
	4.4 Graphs of Logarithmic and exponential functions
		• Observation
		• Written tests
		• Oral questioning
		• Portfolio of evidence

5. Apply binomial expansions	5.1 Roots of numbers using binomial theorem
	   5.1.1 Pascals triangle
	5.2 *Errors* of small changes using binomial theorem
	   5.2.1 Absolute
	   5.2.2 Relative
	   5.2.3 Percentage
	   5.2.4
	5.3 Permutation and combination
		• Observation
		• Third party report
		• Written tests
		• Oral questioning
		• Portfolio of evidence
		• Interviews

6. Apply matrices	6.1 Introduction to matrices 6.1.1 Types of matrices	• Observation • Written tests

	6.1.1.1 singular	• Oral questioning
	6.1.1.2 non-singular	• Portfolio of
	6.1.1.3 identity	evidence
	6.1.1.4 echelon	• Interviews
	6.1.2 Order of matrices	
	6.1.3 Matrix operation	
	6.1.3.1 addition and subtraction	
	6.1.3.2 multiplication by scaler	
	6.1.3.3 compatibility	
	6.1.3.4 Matrix multiplication	
	6.2 Determinant and inverse of 2x2 matrix	
	6.3 Solution of simultaneous equations in two unknowns using matrix method	
	6.4 Eigenvalues and Eigenvectors	
7. Apply vectors	7.1 Vectors and scalar quantities in two dimensions	• Observation
	7.1.1 Definitions of vector and scalar quantities	• Written tests
	7.1.2 Drawing a vector	• Oral questioning
	7.2 Vectors operations	• Portfolio of evidence
	7.2.1 Addition	• Interviews
	7.2.2 Subtraction	
	7.2.3 Scalar multiplication	
	7.3 Position of vectors	
	7.3.1 Modulus of a vector	
	7.4 Resolution of a vector	
8. Apply trigonometry	8.1 Pythagoras theorem	• Observation
	8.2 Trigonometric ratios	• Written tests

	8.2.1 Trigonometry identities 8.2.2 Trigonometric equations 8.2.3 sine and cosine rule 8.3 Angles of elevation and depression 8.4 Compound angle formula 8.4.1 Double angle formula 8.5 Sine and cosine waves	• Oral questioning • Portfolio of evidence • Interviews

9. Apply Calculus	9.1 Differential Calculus
	     9.1.1 Functional notation
	     9.1.2 Standard differentiation
	     9.1.3 Differential equations
	9.2 Methods of differentiation
	     9.2.1 Differentiation by first principle
	     9.2.2 Product rule
	     9.2.3 Quotient rule
	     9.2.4 Chain rule
	9.3 Derivatives of higher order functions
	9.4 Applications of differentiation
	     9.4.1 Normal and tangents
	     9.4.2 Stationary points
	        9.4.2.1 Maxima
	        9.4.2.2 Minima
	        9.4.2.3 Point of inflection
	     9.4.3 Rates of change
	     9.4.4 Small changes
	9.5 Differentiation of inverse
		• Observation
		• Third party report
		• Written tests
		• Oral questioning
		• Portfolio of evidence
		• Interviews

	trigonometric functions	
	9.6 Integral calculus	
	9.6.1 Integral notation	
	9.7 Standard integration	
	9.7.1 Constant of integration	
	9.7.2 Definite and indefinite integration	
	9.8 Methods of integration	
	5.8.1 Algebraic substitution	
	5.8.2 Integration by parts	
	9.9 Integration of logarithmic functions	

10. Apply sequences and series	10.1 Arithmetic sequence
	    10.1.1 arithmetic mean
	    10.1.2 nth term of arithmetic sequence
	10.2 Sum of terms of arithmetic series (Arithmetic progression)
	10.3 Geometric sequence
	10.4 Finite geometric sequence
	10.5 Geometric means and n^{th} terms of a geometric sequence
	10.6 Sum of finite and infinite geometric sequence
		• Observation
		• Third party report
		• Written tests
		• Oral questioning
		• Portfolio of evidence
		• Interviews

11. Apply statistics methods	11.1 Collection of raw data
	    11.1.1 Ungrouped data
	    11.1.2 Grouped data
	11.2 Data presentation
	    11.2.1 Pictograms
	    11.2.2 Histograms
	    11.2.3 Pie charts
	    11.2.4 Bar charts
	    11.2.5 Frequency polygon
		• Observation
		• Third party report
		• Written tests
		• Oral questioning
		• Portfolio of evidence
		• Interviews

	11.3 Processing of raw data
	     11.3.1 Measures of central tendency
	        11.3.1.1 Mean
	        11.3.1.2 Mode
	        11.3.1.3 Median
	     11.3.2 Measures of dispersion
	        11.3.2.1 Range
	        11.3.2.2 Quartile
	        11.3.2.3 Variance
	        11.3.2.4 Standard deviation
	 11.4 Interpretation of processed data	

Suggested Delivery Methods

- Projects
- Practical
- demonstration
- group discussion
- Direct Instruction

Recommended Resources for 25 trainees

S/No.	Category/Item	Description/ Specifications	Quantity	Recommended Ratio (Item: Trainee)
A	**Learning Materials**			
1.	Power point presentations	For trainer's use	1	1:25
B	**Learning Facilities & infrastructure**			
1.	Lecture/theory room	For training	1	1:25
C	**Tools and Equipment**			
1.	Computer	For trainer's use	1	1:25

2.	Scientific calculator	For trainee's use	25	1:1
3.	Projector	For trainer's use	1	1:25
4.	SMP Mathematical table	For trainee's use	25	1:1
5.	White board ruler	For trainer's use	1	1:25
6.	White board compass	For trainer's use	1	1:25
7.	White board protractor	For trainer's use	1	1:25
8.	Geometrical set	For trainee's use	25	1:1
9.	Graph book	For trainee's use	25	1:1