**THE REPUBLIC OF KENYA**

# COMPETENCY BASED CURRICULUM

**FOR**

# BUILDING TECHNOLOGY

**KNQF LEVEL 6**

**ISCED PROGRAM CODE: 0732 554B**

TVET CDACC

P.O BOX 15745-00100

NAIROB

## ENGINEERING MATHEMATICS

### UNIT CODE: CON/CU/BUT/CC/01/6/B

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Apply Engineering Mathematics

**Duration of Unit:** 150 hours

**Unit Description**

This unit describes the competencies required by a technician in order to apply algebra apply trigonometry and hyperbolic functions, apply complex numbers, apply coordinate geometry, carry out binomial expansion, apply calculus, solve ordinary differential equations, carry out mensuration, apply power series, apply statistics, apply numerical methods, apply vector theory and apply matrix.

**Summary of Learning Outcomes**

1. Apply Algebra
2. Apply Trigonometry and hyperbolic functions
3. Apply complex numbers
4. Apply Coordinate Geometry
5. Carry out Binomial Expansion
6. Apply Calculus
7. Solve Ordinary differential equations
8. Carry out Mensuration
9. Apply Power Series
10. Apply Statistics
11. Apply Numerical methods
12. Apply Vector theory
13. Apply Matrix

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

| **Building Technology Curriculum** | | |
|---|---|---|
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Apply Algebra | • Base and Index<br>• Law of indices<br>• Indicial equations<br>• Laws of logarithm<br>• Logarithmic equations<br>• Conversion of bases<br>• Use of calculator<br>• Reduction of equations<br>• Solution of equations reduced to quadratic form<br>• Solutions of simultaneous linear equations in three unknowns<br>• Solutions of problems involving AP and GP | • Written Tests<br>• Oral Questioning<br>• Assignments<br>• Supervised exercises |

| | | |
|---|---|---|
| 2. Apply Trigonometry and hyperbolic functions | • Half -angle formula<br>• Factor formula<br>• Trigonometric functions<br>• Parametric equations<br>• Relative and absolute measures<br>• Measures calculation<br>• Definition of hyperbolic equations<br>• Properties of hyperbolic functions<br>• Evaluations of hyperbolic functions Hyperbolic identities<br>• Osborne's Rule<br>• Ashx+bshx=C equation<br>• One-to-one relationship in functions<br>• Inverse functions for one-to-one relationship<br>• Inverse functions for trigonometric functions<br>• Graph of inverse functions<br>• Inverse hyperbolic functions | • Written Tests<br>• Oral Questioning<br>• Assignments<br>• Supervised exercises |
| 3. Apply complex numbers | • Definition of complex numbers<br>• Stating complex numbers in numbers in terms of conjugate argument and<br>• Modulus<br>• Representation of complex numbers on the Argand diagram<br>• Arithmetic operation of complex numbers Application of De Moivre's theorem | • Assignments<br>• Oral Questioning<br>• Supervised exercises<br>• Written Tests |

| | | |
|---|---|---|
| | • Application of complex numbers to engineering | |
| 4. Apply Coordinate Geometry | • Polar equations<br>• Cartesian equation<br>• Graphs of polar equations<br>• Normal and tangents<br>• Definition of a point<br>• Locus of a point in relation to a circle<br>• Loci of points for given mechanism | • Written Tests<br>• Oral Questioning<br>• Assignments<br>• Supervised exercises |
| 5. Carry out Binomial Expansion | • Binomial theorem Power series using binomial theorem Roots of numbers using binomial theorem.<br>• Estimation of errors of small changes using binomial theorem. | • Written Tests<br>• Oral Questioning<br>• Assignments<br>• Supervised exercises |

| | | |
|---|---|---|
| 6. Apply Calculus | • Definition of derivatives of a function<br>• Differentiation from fist principle<br>• Tables of some common derivatives<br>• Rules of differentiation<br>• Rate of change and small change<br>• Stationery points of functions of two variables<br>• Definition of integration<br>• Indefinite and definite integral<br>• Methods of integration application of integration.<br>• Integrals of hyperbolic and inverse functions | • Written Tests<br>• Oral Questioning<br>• Assignments<br>• Supervised exercises |
| 7. Solve Ordinary differential equations | • Types of first order differential equations<br>• Formation of first order differential equation<br>• Solution of first order differential equations<br>• Application of first order differential equations<br>• Formation of second order differential equations for various systems | • Written Tests<br>• Oral Questioning<br>• Assignments<br>• Supervised exercises |

| | | |
|---|---|---|
| | • Solution of second order differential equations<br>• Application of second order differential equations | |
| 8. Carry out Mensuration | • Units of measurements<br>• Perimeter and areas of regular figures<br>• Volume of regular solids<br>• Surface area of regular solids<br>• Area of irregular figures<br>• Areas and volumes using Pappus theorem | • Written Tests<br>• Oral Questioning<br>• Assignments<br>• Supervised exercises |
| 9. Apply Power Series | • Definition of the term power series<br>• Taylor's theorem<br>• Deduction of McLaurin's theorem to obtain power series<br>• Application of Taylor's theorem and McLaurin's theorems in numerical work | • Written Tests<br>• Oral Questioning<br>• Assignments<br>• Supervised exercises |
| 10. Apply Statistics | • Measures of central tendency mean, mode and median<br>• Measures of dispersion<br>  ○ Variance and standard deviation<br>• Definition of probability<br>• Laws of probability | • Assignments<br>• Oral Questioning<br>• Supervised exercises<br>• Written Tests<br>• Simulation<br>• Data modelling |

| | | |
|---|---|---|
| | • Expectation variance and S.D.<br>• Types of distributions<br>• Mean, variance and SD of probability distributions<br>• Application of probability distributions | |
| 11. Apply Numerical methods | • Definition of interpolation and extrapolation<br>• Application of interpolation<br>• Application of interactive methods to solve equations<br>• Application of interactive methods to areas and volumes | • Assignments<br>• Oral Questioning<br>• Supervised exercises<br>• Written Tests |
| 12. Apply Vector theory | • Vectors and scalar in two and three dimensions<br>• Operations on vectors: Addition and Subtraction<br>• Position vectors<br>• Resolution of vectors | • Assignments<br>• Oral Questioning<br>• Supervised exercises<br>• Written Tests |
| 13. Apply Matrix methods | • Matrix operation<br>• Determinant of 3x3 matrix<br>• Inverse of 3x3 matrix<br>• Solution of linear simultaneous equations in 3 unknown<br>• Application of matrices | • Assignments<br>• Oral Questioning<br>• Supervised exercises<br>• Written Tests |

**Suggested Methods of Instruction:**

- Group discussions
- Demonstration by trainer
- Exercises by trainee

**Recommended Resources**

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