COMMON UNITS OF COMPETENCY

APPLY ENGINEERING MATHEMATICS

UNIT CODE:ENG/OS/PO/CC/01/5/A

UNIT DESCRIPTION

This unit describes the competencies required by an Electrical Technician to apply a wide range of engineering mathematics in their work. This includes applying algebraic functions, applying trigonometry and hyperbolic functions, Complex numbers, coordinate geometry, carrying out binomial expansion, calculus, Statistics, Vector theory, Matrix and Numerical methods in solving problems, Concepts of probability for work, performing commercial calculations, Performing estimations, measurements and calculations of quantities

ELEMENTS 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	1.1 Calculations involving Indices are performed as per the concept 1.2 Calculations involving Logarithms are performed as per the concept 1.3 Scientific calculator is used in solving mathematical problems in line with manufacturer's manual 1.4 Simultaneous equations are performed as per the rules 1.5 Quadratic equations are calculated as per the concept
2. Apply Trigonometry and hyperbolic functions	2.1 Calculations are performed using trigonometric rules 2.2 Calculations are performed using ***hyperbolic functions***
3. Apply complex numbers	3.1 Complex numbers are represented using Argand diagrams 3.2 Operations involving complex numbers are performed 3.3 Calculations involving complex numbers are performed using De Moivre's theorem
4. Apply Coordinate Geometry	1.1 Polar equations are calculated using coordinate geometry 1.2 Graphs of given polar equations are drawn using

	the Cartesian plane 1.3 Normal and tangents are determined using coordinate geometry
5. Carry out Binomial Expansion	5.0 Roots of numbers are determined using binomial theorem 5.1 Errors of small changes are determined using binomial theorem
6. Apply Calculus	6.0 Derivatives of functions are determined using Differentiation 6.1 Derivatives of hyperbolic functions are determined using Differentiation 6.2 Derivatives of inverse trigonometric functions are determined using Differentiation 6.3 Rate of change and small change are determined using Differentiation. 6.4 Calculation involving stationery points of functions of two variables are performed using differentiation. 6.5 Integrals of algebraic functions are determined using integration
7. Apply Statistics	7.1 Identification, Collection and Organization of data is performed 7.2 Interpretation, analysis and presentation of data in appropriate format is performed 7.3 Mean, median ,mode and Standard deviation are obtained from given data 7.4 Calculations are performed based on Laws of probability 7.5 Calculation involving probability distributions , mathematical expectation sampling distributions are performed
8. Apply vector theory	8.1 Calculations involving vector algebra, dot and cross products using vector theory 8.2 Gradient, Divergence and Curl are obtained 8.3 Vector calculations are performed using Green's theorem 8.4 Vector calculations are performed using Stoke's theorem 8.5 Conservative vector fields and line and surface integrals are obtained using Gauss's theorem
9. Apply Matrix	1.1 Determinant and inverse of 3x3 matrix are obtained 1.2 Solutions of simultaneous equations are obtained 1.3 Calculation involving Eigen values and Eigen

	vectors are performed
10. Apply Numerical methods	1.4 Roots of polynomials are obtained using iterative numerical methods 1.5 Interpolation and extrapolation are performed using numerical methods
11. Apply concepts of probability for work	1.6 Probability events are determined from dependent, independent and mutually exclusive 1.7 Counting is done using permutation, combination, tree diagrams and Venn diagrams techniques
12. Perform commercial calculations	1.8 Exchange rates calculations are done using devaluation and revaluation 1.9 Sales, stock turnover and profit and loss are determined 1.10 Incomes, salaries and wages are calculated
13. Perform estimations, measurements and calculations of quantities	1.11 Measurement information in workplace is extracted and interpreted 1.12 Appropriate workplace measuring tools and equipment are identified and selected 1.13 Conversions are performed between units of measurement 1.14 Measurements are estimated and taken 1.15 Length, width, height, perimeter, area and angles of ***figures*** are calculated 1.16 Volume and surface area of figures are calculated 1.17 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
2. Figures may include but not limited to:	• Triangles • Squares • Rectangles

	• Circles • Spheres • Cylinders • Cubes • Polygons • Cuboids • Pyramids
3. Quantities may include but not limited to:	• Weight, • Mass • Area • Volume • Length • Width • Depth • Perimeter

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 and knowledge and range.

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Applied Trigonometry and hyperbolic functions 1.2 Applied complex numbers 1.3 Determined angles and length in triangles 1.4 Applied Calculus 1.5 Applied Vector theory 1.6 Applied Matrix 1.7 Identified and selected measuring equipments 1.8 Collected, Analyzed and presented data 1.9 Applied Numerical methods
2. Resource Implications	The following resources should be provided: 1.10 Access to relevant workplace or appropriately simulated environment where assessment can take place 1.11 Measuring equipment 1.12 Materials relevant to the proposed activity or tasks
3. Methods of Assessment	Competency in this unit may be assessed through: 1.13Direct Observation 1.14Demonstration with Oral Questioning 1.15Written tests
4. Context of Assessment	Competency may be assessed individually in the actual workplace or through accredited institution or during industrial attachment.
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.