APPLY ENGINEERING MATHEMATICS

UNIT CODE:CON/OS/BUT/CC/1/6

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.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT 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

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3. Apply complex numbers	1.1 Complex numbers are represented using Argand diagrams 1.2 Operations involving complex numbers are performed 1.3 Calculations involving complex numbers are performed using De Moivre's theorem
4. Apply Coordinate Geometry	4.1 Polar equations are calculated using coordinate geometry 4.2 Graphs of given polar equations are drawn using the Cartesian plane 4.3 Normal and tangents are determined using coordinate geometry
5. Carry out Binomial Expansion	1.1 Roots of numbers are determined using binomial theorem 1.2 Errors of small changes are determined using binomial theorem
6. Apply Calculus	6.2 Derivatives of functions are determined using Differentiation 6.3 Derivatives of hyperbolic functions are determined using Differentiation 6.4 Derivatives of inverse trigonometric functions are determined using Differentiation 6.5 Rate of change and small change are determined using Differentiation. 6.6 Calculation involving stationery points of functions of two variables are performed using differentiation. 6.7 Integrals of algebraic functions are determined using integration 6.8 Integrals of trigonometric functions are determined using integration 6.9 Integrals of logarithmic functions are determined using integration 6.10 Integrals of hyperbolic and inverse functions are determined using integration

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7. Solve Ordinary differential equations	6.1 First order and second order differential equations are solved using the method of undetermined coefficients 7.2 First order and second order differential equations are solved from given boundary conditions
8. Carry out Mensuration	8.1 Perimeter and areas of figures are obtained 8.2 Volume and of Surface area of solids are obtained 8.3 Area of irregular figures are obtained 8.4 Areas and volumes are obtained using Pappus theorem
9. Apply Power Series	1.1 Power series are obtained using Taylor's Theorem 1.2 Power series are obtained using McLaurin's 's theorem
10. Apply Statistics	10.1 Mean, median ,mode and Standard deviation are obtained from given data 10.2 Calculations are performed based on Laws of probability 10.3 Calculation involving *probability distributions* , mathematical expectation sampling distributions are performed 10.4 Sampling distribution methods are applied in data analysis 10.5 Calculations involving use of standard normal table, sampling distribution, T-distribution and Estimation are done 10.6 Confidence intervals are determined
11. Apply Numerical methods	1.1 Roots of polynomials are obtained using iterative *numerical methods* 1.2 Interpolation and extrapolation are performed using numerical methods

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12. Apply Vector theory	12.1 Vectors and scalar quantities are obtained in two and three dimensions 12.2 *Operations* on vectors are performed 12.3 Position of vectors is obtained 12.4 Resolution of vectors is done
13. Apply Matrix	13.1 Determinant and inverse of 3x3 matrix are obtained 13.2 Solutions of simultaneous equations are obtained 13.3 Calculation involving Eigen values and Eigen vectors are performed

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 *May include but not limited to:*
1. Operations	1.1. Addition 1.2. Subtraction
2. Hyperbolic functions	2.1. Sinh x 2.2. Cosh x 2.3. Cosec x 2.4. Coth x 2.5. Tanh x 2.6. Sech x
3. Probability Distributions	3.1. Binomial 3.2. Poisson 3.3. Normal
4. Numerical Methods	4.1. Newton Raphson

	4.2. Gregory Newton

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: 1.4 Applied Trigonometry and hyperbolic functions 1.5 Applied complex numbers 1.6 Applied Calculus

	1.7 Solved Ordinary differential equations 1.8 Carried out mensuration 1.9 Applied Power Series 1.10 Applied Vector theory 1.11 Applied Matrix 1.12 Applied Numerical methods
2. Resource Implications	The following resources should be provided: 2.1 Access to relevant workplace or appropriately simulated environment where assessment can take place 2.2 Measuring equipment 2.3 Materials relevant to the proposed activity or tasks
2. Methods of Assessment	Competency in this unit may be assessed through: 1.1 Direct Observation 1.2 Demonstration with Oral Questioning 1.3 Written tests
Context of Assessment	Competency may be assessed individually in the actual workplace or through accredited institution
Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.