DCSMTH637: Use Mathematics in Engineering

UNIT CODE		**DCSMTH637**	
UNIT TITLE		**Use mathematics in engineering**	
APPLICATION		This unit covers concepts of mathematics appropriate to engineering situations. The unit of competency is applied by technicians and drafting personnel working in a civil and structural engineering environment to solve problems. No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.	
PREREQUISITE UNIT(S)		Group A Mathematics Elective: Either MEM30012 Apply mathematical techniques in a manufacturing, engineering or related environment; **OR** DCSBME631 Use basic mathematics in engineering	
ELEMENTS		**PERFORMANCE CRITERIA**	
Elements describe the essential outcomes.		Performance criteria describe the performance needed to demonstrate achievement of the element.	
1	Use exponential functions and their graphs.	1.1	Simplify algebraic expressions containing indices using the index laws.
		1.2	Transpose formulae involving indices.
		1.3	Solve simple exponential equations using the index laws and without using logarithms.
		1.4	Draw and interpret graphs of exponential functions.
2	Use logarithmic equations and their graphs in problem solving.	2.1	Interpret the meaning of a logarithm as an exponent.
		2.2	Evaluate logarithms using a calculator.
		2.3	Simplify expressions using the laws of logarithms.
		2.4	Solve exponential equations using logarithms.
		2.5	Transpose formulae involving the exponential or logarithmic function.
		2.6	Draw the graph of the logarithmic function.
		2.7	Transpose exponential and power equations into logarithmic form so they can be plotted as linear graphs.
		2.8	Solve problems involving exponential growth and decay, graphically and analytically.
3	Solve problems involving trigonometry.	3.1	Define sin θ, cos θ and tan θ in terms of the unit circle.

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		3.2	Define the reciprocal trigonometric ratios cosecant, secant and cotangent in terms of sine, cosine and tangent, respectively.
		3.3	Convert radians to degrees and degrees to radians.
		3.4	Determine from the trigonometric ratio the measure of any angle in either degrees or radians.
		3.5	Calculate the area of a sector using $A = 1/2\ r^2\theta$ (θ given in degrees or radians).
		3.6	Solve applied problems requiring the use of the sine rule and/or cosine rule.
4	Perform operations with matrices and determinants.	4.1	Add, subtract and multiply matrices, including multiplying a matrix by a scalar.
		4.2	Define and calculate the determinant of a 2 x 2 and 3 x 3 matrix.
		4.3	Obtain the inverse of a 2 x 2 and 3 x 3 matrix using the determinant.
		4.4	Solve a system of 3 linear equations in 3 unknowns using both the inverse matrix method and determinants (Cramer's Rule).
		4.5	Solve applied problems using matrices.
5	Apply elementary calculus techniques.	5.1	Differentiate elementary algebraic functions.
		5.2	Differentiate algebraic functions using the product, quotient and chain rules.
		5.3	Integrate elementary algebraic functions.
		5.4	Evaluate area under the curve for simple functions using definite integral.
		5.5	Apply Simpson's rule to approximate the area under a curve.

FOUNDATION SKILLS
Foundation skills essential to performance are explicit in the performance criteria of this unit of competency.

UNIT MAPPING INFORMATION
DCSMTH610 Use mathematics in engineering is equivalent.

TITLE	**Assessment requirements for DCSMTH637 Use mathematics in engineering**

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PERFORMANCE EVIDENCE	To achieve competency in this unit, a person must satisfy the requirements of the elements and performance criteria, foundation skills and range of conditions included in the unit. The person must also: • correctly solve written problems in mathematics • correctly solve problems using software • report and present data in an appropriate format Note: If a specific volume or frequency is not stated, then evidence must be provided at least once for each criterion.
KNOWLEDGE EVIDENCE	To achieve competency in this unit, a person must demonstrate knowledge of key concepts in mathematics, including • the laws of indices and logarithms • the procedures for simplifying arithmetic and algebraic expressions • the procedures for sketching exponential and logarithmic functions*0 • the procedures for converting logarithms between bases • the concept of growth and decay • the procedures for solving problems involving growth and decay • the selection of the correct rule to solve oblique triangles • various ways of solving a system of simultaneous equations • simple differentiation and integration rules • function notation • the procedures relating to Simpson's Rule • use of software

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ASSESSMENT CONDITIONS	**Assessment Conditions:** All assessment must be completed in accordance with work health and safety standards. When assessments are conducted remotely, invigilation software must be used to ensure authenticity of work completed. Model answers or marking guides must be provided for all assessments to ensure reliability of assessment judgements when marking is undertaken by different assessors. Assessors must gather a range of evidence that is valid, sufficient, authentic, and current. Questioning techniques must not require language, literacy and numeracy skills beyond those required in this module. The candidate must have access to all tools, equipment, materials and documentation required. **Assessor Requirements:** Assessment must be conducted only by persons who: • hold vocational competencies at least to the level being delivered and assessed • maintain current industry skills directly relevant to the training and assessment being provided • hold a tertiary qualification in engineering or a related field • meet the assessor requirements specified in the current Standards for Registered Training Organisations (RTOs) • undertake ongoing professional development in vocational training, learning, and assessment, including competency-based training and assessment, as required by their RTO. The RTO must also ensure that trainers and assessors keep their industry knowledge up to date through ongoing professional development. The RTO must take appropriate steps, as an ongoing procedure, to verify information about trainer and assessor's qualifications.