

Course Title:	Engineering Mathematics I
Course Code:	ENGE501
Descriptor Start Date:	01/01/2022
Descriptor End Date:	30/01/2023
POINTS:	15.00
LEVEL:	5
PREREQUISITE/S:	ENGE401
COREQUISITE/S:	None
RESTRICTION/S:	ENGE502

LEARNING HOURS

Hours may include lectures, tutorials, online forums, laboratories. Refer to your timetable and course information in Canvas for detailed information.

Total learning hours: 150

PRESCRIPTOR

Gives the student an understanding of differential and integral calculus, and develops the ability to formulate and solve models of simple engineering and scientific systems.

Key to Graduate Capabilities Profile :

- a. Engineering knowledge
- b. Problem analysis
- c. Design/development of solutions
- d. Investigation
- e. Tool usage
- f. The engineer and the world
- g. Ethics h. Individual and collaborative team-work
- i. Communication
- j. Project management and finance
- k. Lifelong learning

Disclaimer: Course descriptors may be amended between teaching periods/semesters

LEARNING OUTCOMES

1. Manipulate and describe many of the important functions used in Mathematics and Engineering applications. (a,b,c,d,g,h,j)
2. Calculate and appreciate limits (a,b,c,d,g,h,j)
3. Calculate inverse functions (a,b,c,d,g,h,j)
4. Thoroughly understand and apply differentiation and integration. (a,b,c,d,g,h,j)
5. Comprehend and apply vector geometry and vector geometry. (a,b,c,d,g,h,j)
6. Recognise the importance of complex numbers and apply them to engineering problems (a,b,c,d,g,h,j)
7. Understand systems of linear equations and appreciate their notation in matrix-form. (a,b,c,d,g,h,j)
8. Formulate and manipulate matrices. (a,b,c,d,g,h,j)

CONTENT

Calculus:

Sets and functions $\square, \square, \square, \square$, open & closed intervals, sets defined by inequalities, sums, products, quotients & composites of functions, polynomials, rational & trig functions, implicitly defined functions

Inverse functions The concept of inverse functions, inverse trigonometric functions, exponential and logarithmic functions, applications

Limits and continuity Informal definition of limits, limit rules, continuous functions, applications

Differentiation Derivatives, differentiable functions, rules of differentiation, implicit differentiation, applications

Integration Definite integrals, indefinite integrals, integration by substitution and by parts, applications

Algebra (non-calculus):

Introduction to vectors Vector quantities, analytic geometry, parametric vector equations, planes, linear combinations

Vector geometry Length, angle and dot product, orthogonality, projection of one vector on another, distance of a point to a line, cross product

Complex numbers Definition and basic operations, complex conjugates and division, polar form, powers and roots of complex numbers

Matrices Matrix notation, operations on matrices, transposes, inverses and definition of determinants, properties of determinants, elementary row operations

Linear equations and matrices Introduction to systems of linear equations, geometrical interpretations, solving systems of equations via inverse matrices and via Gaussian elimination.

Key to Graduate Capabilities Profile

- a. Engineering knowledge
- b. Problem analysis
- c. Design/development of solutions
- d. Investigation
- e. Modern tool usage
- f. The engineer and society
- g. Environment and sustainability
- h. Ethics
- i. Individual and team work
- j. Communication
- k. Project management and finance
- l. Lifelong learning

LEARNING & TEACHING STRATEGIES

Course content is presented through lectures per week conveying the theory, providing worked examples and applications, along with computer labs and tutorial reviews each week. The student will apply this theory through assignments and tests, which form an integral part of the course. The course will introduce students to Matlab and will further on include Matlab as a standard computer tool to solve problems related to the content taught.

ASSESSMENT PLAN

Assessment Event	Weighting %	Learning Outcomes
Matlab based assessment	10.00	1-8
Problem-solving questionnaire	30.00	1-5
Final problem-solving questionnaire	60.00	2-5

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Grade Map**MAP1**

A+ A A- Pass with Distinction

B+ B B- Pass with Merit

C+ C C- Pass

D Fail

Overall requirement/s to pass the course:

To pass the course, the student needs to gain:

a minimum of 50% overall, AND

a minimum of 40% in overall coursework, AND

a minimum of 40% in Final problem-solving questionnaire.

LEARNING RESOURCES

Stewart, J.: Calculus : Concepts and Contexts, 4th edition, Brooks/Cole, 2010
Hardy, K.: Linear Algebra for Engineers and Scientists Using Matlab, Pearson, 2014

For further information, contact: Te Ara Auaha - Faculty of Design & Creative Technologies**Principal Programme:** AK3751, Bachelor of Engineering (Honours)**Related Programme/s:** AK3719
AK3697**Disclaimer: Course descriptors may be amended between teaching periods/semesters**