

Class Code: MM114		Class Title: Engineering Mathematics 2E	
Type: UG NE	Level: 1	Credits: 20	Semester: 2
Class Coordinator: Dr D Greenhalgh		Tel: 3653 Email: david.greenhalgh@strath.ac.uk	
Teaching Staff: Dr D Greenhalgh			
Pre-requisites: MM113 or equivalent			
Students: Compulsory: Electrical and Electronic Engineering, Computer and Electronic Systems, Electrical and Mechanical Engineering			
Overlaps: MM101, MM102, MM103, MM110, MM112, MM115, MM116, MM117			

CLASS DELIVERY (HOURS)

LECTURES	TUTORIALS	LABORATORIES	ASSIGNMENTS	SELF STUDY	TOTAL
44	11	11	36	98	200

CLASS ASSESSMENT

Course work on engineering applications (25%); 2 hour degree examination in mathematics (75%) in May. August resit examination (100%). Exemption from degree examination is possible based upon performance in class tests, attendance at tutorials and assignments.

GENERAL AIMS

To give a basic understanding of the concepts and applications of calculus, geometry, vectors, matrices and numerical methods.

LEARNING OUTCOMES

On completion of this class, the student should be

- able to differentiate functions defined either implicitly or parametrically;
- able to determine stationary points of a function and to solve practical max/min problems;
- able to use integration to calculate the area between two curves, volumes of solids of revolution, and lengths of planar curves;
- familiar with the equations of a straight line and a circle in 2 dimensions;
- familiar with the concept of a vector and the fundamental operations with vectors: addition, multiplication by a scalar, and scalar and vector products;
- able to find and use equations for lines and planes in 3 dimensions;
- able to carry out standard matrix operations;
- able to express systems of linear equations in matrix form, and to apply elementary row operations on the associated augmented matrix to find the solution of a given system;
- able to use the Trapezoidal/Simpson's Rule to approximate a definite integral; and
- able to use Newton's method to find a root of a nonlinear equation (e.g. a polynomial or trig. equation).

SYLLABUS

Further Calculus:

Implicit differentiation – first derivatives and simple cases of second derivatives.

Parametric differentiation – first derivatives and simple cases of second derivatives.

Applications of differentiation – graph sketching; stationary points; optimisation problems; related rates of change; linear approximation and error analysis.

Applications of integration – area between two curves; volumes of revolution about x and y axes; arc length of a plane curve.

Geometry and Vectors:

2-D geometry – Cartesian coordinates and polar coordinates; distance formula; equations of lines and circles; intersection of lines.

Conics sections – general second-order equation in two variables (without “cross term”); canonical forms of ellipse, hyperbola and parabola.

Vectors – motivation: quantities having magnitude and direction, e.g. force, velocity, displacement, etc; vectors as directed line segments; vector algebra; orthogonal unit vectors; representation of vectors as number triples; scalar and vector products, with applications.

3-D geometry – equation of a line through two points or through a point in a given direction; intersection of lines; equation of a plane through three points or through a point with a given normal vector; intersection of a line and a plane.

Matrices and Systems of Linear Equations and Numerical Methods:

Matrix algebra – definitions, notation, and some special matrices; multiplication by a constant; addition of matrices; matrix multiplication.

Matrix inverse – definition of the inverse of a square matrix, examples; the inverse of a 2×2 matrix; singular and non-singular matrices.

Linear equations – representation of a system of linear equations in matrix form.

Solution of systems of linear equations – Augmented matrix for n equations in n unknowns; reduction to triangular form using elementary row operations; unique solution, non-uniqueness and inconsistency.

Numerical integration – Trapezoidal rule, Simpson's Rule.

Numerical solution of non-linear equations – Newton's method.

Transferable Skills: See Level 1S spreadsheet for details.

RECOMMENDED TEXT/READING

** Croft, A. & Davison, R., *Mathematics for Engineers, A Modern Interactive Approach*, 3rd Edition, Prentice Hall. ISBN: 10 0132051567, ISBN-13: 978-0132051569.

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