Liverpool John Moores University

Title:	ADVANCED MATHEMATICS
Status:	Definitive
Code:	**5503ICBTCE** (126970)
Version Start Date:	01-08-2021
Owning School/Faculty:	Civil Engineering and Built Environment
Teaching School/Faculty:	ICBT, Colombo

Team	Leader
Alison Cotgrave	Y

Academic Level:	FHEQ5	**Credit Value:**	15	**Total Delivered Hours:**	47
Total Learning Hours:	150	**Private Study:**	103		

Delivery Options
Course typically offered: Semester 1 and Summer

Component	Contact Hours
Lecture	30
Tutorial	15

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Report	AS1	Investigative Report (1500 words)	30	
Exam	AS2	Written Examination (Closed Book)	70	2

Aims

To develop skills in advanced engineering mathematics for application to the solution of Civil and Building Services Engineering problems.

Learning Outcomes

After completing the module the student should be able to:

1 Use number systems to model & solve engineering problems
2 Apply graphical and numerical methods to model and solve engineering problems
3 Apply vector geometry and matrix methods to model and solve engineering problems
4 Use ordinary differential equations to model and solve engineering problems

Learning Outcomes of Assessments

The assessment item list is assessed via the learning outcomes listed:

Coursework	2		
Written Examination	1	3	4

Outline Syllabus

Error arithmetic: significant figures and estimation techniques, error arithmetic operations, systematic and random errors, application to experimentation and general laboratory work

Number systems: natural, integer, rational, reals, dinary, binary, octal and hexadecimal number systems.

Complex numbers: real and imaginary parts of complex numbers, complex number notation. Cartesian and polar forms, Argand diagrams, powers and roots and the use of de Moivre's theorem, use of phasor and Argand diagrams

Numerical integral: determine the integral of functions using mid-ordinate, trapezoidal and Simpson's rules

Numerical estimation methods: method of bisection, Newton-Raphson iteration method, estimates of scientific functions

Vector notation and operations: Cartesian co-ordinates and unit vectors, types of vector and vector representation, addition and subtraction, multiplication by a scalar, graphical methods

Matrix operations and vectors: carry out a range of matrix operations, e.g. vectors in matrix form, square and rectangular matrices, row and column vectors, significance of the determinant, determinant for 2x2 matrix, the inverse of a 2x2 matrix, Gaussian elimination to solve systems of linear equations (up to 3x3),

Vector geometry: determine scalar product, vector product, angle between two vectors, equation of a line, norm of a vector, dot and cross products

First order differential equations: engineering use, separation of variables, integrating factor method, complementary function and particular integral

Numerical methods for first order differential equations: need for numerical solution, Euler's method, improved Euler method, Taylor series method

Application of second order differential equations:

Engineering situations: applications, e mechanical systems, fluid systems, etc.

Finite Difference and finite element methods

Learning Activities

Students will be supported in their learning, to achieve the above learning outcomes, in the following ways:

By a series of lectures and tutorials and through participation within practical sessions for problem solving.

Self-managed investigative study to analyse cases related to the industry

In-class participation and case studies are key features of this module.

A recommended resource list - indicating key reading, internet support and physical learning assistance, is provided to help enable students to undertake self-directed study.

Notes

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