

#### Summary Information

Module Code	5421ELE
Formal Module Title	Advanced Mathematics
Owning School	Engineering
Career	Undergraduate
Credits	10
Academic level	FHEQ Level 5
Grading Schema	40

#### Teaching Responsibility

LJMU Schools involved in Delivery
Engineering

#### Learning Methods

Learning Method Type	Hours
Lecture	22
Tutorial	22

#### Module Offering(s)

Display Name	Location	Start Month	Duration Number Duration Unit
SEP-CTY	CTY	September	12 Weeks

#### Aims and Outcomes

Aims	To provide a foundation in engineering mathematics for application to the solution of engineering problems
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After completing the module the student should be able to:

## Learning Outcomes

Code	Number	Description
MLO1	1	Solve linear, first order, constant coefficient ordinary differential equations by the method of integrating factor and apply to the modelling of engineering problems
MLO2	2	Solve linear, second order, constant coefficient ordinary differential equations and apply to the modelling of engineering problems
MLO3	3	Find first and second order partial derivatives for functions of several variables and apply to engineering problems using optimisation and errors
MLO4	4	Use eigenvectors and eigenvalues in the solution of engineering problems
MLO5	5	Solve simultaneous homogeneous ordinary differential equations with constant coefficients and apply to the solution of a two degree of freedom system
MLO6	6	Use Laplace transforms in the solution of engineering problems involving ordinary differential equations
MLO7	7	Use Fourier series in the solution of engineering problems
MLO8	8	Find numerical solutions of ordinary differential equations
MLO9	9	Apply symbolic mathematical software e.g. Mathcad in the solution to problems involving topics on the syllabus.

## Module Content

Outline Syllabus	The solution of first order ODE's by the integrating factor method. The solution of second order ODE's by the method of undetermined coefficients. Application to single degree of freedom oscillating systems. Functions of several variables. Partial differentiation with application to optimisation and error estimation. Eigenvalues and eigenvectors. By manual calculation for low order matrices. Use of software for matrices of larger order. Solution of two first and second order, homogeneous simultaneous ODE's with constant coefficients. Application to normal modes for a two degree of freedom system. Laplace transforms. Concepts. Use of tables. The inverse transform. Application to the solution of ODE's. Transfer functions and stability. Periodic functions. Fourier series for functions of any period. Harmonics. Numerical solution of ODE's. Euler's method and application of software. The use of a symbolic mathematical package e.g. Mathcad in the solution of problems involving the above topics.
Module Overview	
Additional Information	UNESCO Sustainable Development Goals Quality Education Gender Equality Industry, Innovation and Infrastructure Partnerships for the Goals UK SPEC AHEP 4CEng.M1 Apply a comprehensive knowledge of mathematics, statistics, natural science and engineering principles to the solution of complex problems. Much of the knowledge will be at the forefront of the particular subject of study and informed by a critical awareness of new developments and the wider context of engineering. M2 Formulate and analyse complex problems to reach substantiated conclusions. This will involve evaluating available data using first principles of mathematics, statistics, natural science and engineering principles, and using engineering judgment to work with information that may be uncertain or incomplete, discussing the limitations of the techniques employed. M3 Select and apply appropriate computational and analytical techniques to model complex problems, discussing the limitations of the techniques employed. IEng.B1 Apply knowledge of mathematics, statistics, natural science and engineering principles to broadly-defined problems. Some of the knowledge will be informed by current developments in the subject of study. B2 Analyse broadly-defined problems reaching substantiated conclusions using first principles of mathematics, statistics, natural science and engineering principles. B3 Select and apply appropriate computational and analytical techniques to model broadly-defined problems, recognising the limitations of the techniques employed. Where this module is part of a Degree Apprenticeship programme, the knowledge learning outcomes is K1.

## Assessments

Assignment Category	Assessment Name	Weight	Exam/Test Length (hours)	Module Learning Outcome Mapping
Report	Online assessment	100	0	MLO1, MLO2, MLO3, MLO4, MLO5, MLO6, MLO7, MLO8, MLO9

## Module Contacts