

## Liverpool John Moores University

Title: Engineering Mathematics 2  
Status: Definitive  
Code: **5110MSE** (120716)  
Version Start Date: 01-08-2018

Owning School/Faculty: Maritime and Mechanical Engineering  
Teaching School/Faculty: Maritime and Mechanical Engineering

Team	Leader
Robert Wilkinson	Y

**Academic Level:** FHEQ5      **Credit Value:** 10      **Total Delivered Hours:** 50  
**Total Learning Hours:** 100      **Private Study:** 50

### Delivery Options

Course typically offered: Standard Year Long

Component	Contact Hours
Lecture	24
Tutorial	24

**Grading Basis:** 40 %

### Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Test	AS1	Weekly online coursework delivered using a virtual learning environment	30	
Exam	AS2	2hrs online using a virtual learning environment	70	2

### Aims

*To provide a foundation in advanced engineering mathematics for application to the solution of engineering problems*

### Learning Outcomes

After completing the module the student should be able to:

- 1 Solve linear, second order, constant coefficient ordinary differential equations and apply to the modelling of engineering problems
- 2 Find first and second order partial derivatives for functions of several variables and apply to engineering problems involving optimisation and errors
- 3 Use eigenvectors and eigenvalues in the solution of engineering problems
- 4 Solve simultaneous homogeneous ordinary differential equations with constant coefficients and apply to the solution of a two degree of freedom system
- 5 Use Laplace transforms in the solution of engineering problems involving ordinary differential equations
- 6 Use Fourier series in the solution of engineering problems
- 7 Find numerical solutions of ordinary differential equations
- 8 Find and apply Z transforms to engineering problems.
- 9 Use differential vector calculus and appreciate its application in engineering.
- 10 Apply symbolic mathematical software eg. Mathcad in the solution to problems involving topics on the syllabus.

### Learning Outcomes of Assessments

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

Weekly online cw using VLE	1	2	3	4	5	6	7	8	9	10
2 hour online exam using VLE	1	2	3	4	5	6	7	8	9	10

### Outline Syllabus

*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.*

*Introduction to vector calculus. Divergence, gradient and curl and their physical meanings and applications.*

*Z transforms. Definition and properties. Inversion. Applications.*

*The use of a symbolic mathematical package eg Mathcad in the solution of problems involving the above topics.*

### Learning Activities

A combination of lectures and tutorials

### **Notes**

This module provides a foundation in advanced engineering mathematics for level 5 students in mechanical and electrical engineering.

For each topic area of the syllabus, relevant commands will be given for application of a symbolic algebra package, e.g. Mathcad to harder problems.

Coursework assessment will be through online questions delivered using a virtual learning environment. The examination will be online also delivered using a virtual learning environment. Examinees will have access to the same symbolic mathematical software used in the module eg. Mathcad.