Module Proforma

Approved, 2022.01

Summary Information

Module Code	5521USST
Formal Module Title	Advanced Mathematics
Owning School	Engineering
Career	Undergraduate
Credits	10
Academic level	FHEQ Level 5
Grading Schema	40

Module Contacts

Module Leader

Contact Name	Applies to all offerings	Offerings
Dante Matellini	Yes	N/A

Module Team Member

Contact Name	Applies to all offerings	Offerings

Partner Module Team

Contact Name	Applies to all offerings	Offerings

Teaching Responsibility

LJMU Schools involved in Delivery
LJMU Partner Taught

Partner Teaching Institution

Institution Name
University of Shanghai For Science and Technology

Learning Methods

Learning Method Type	Hours
Lecture	22
Tutorial	22

Module Offering(s)

Offering Code	Location	Start Month	Duration
SEP-PAR	PAR	September	12 Weeks

Aims and Outcomes

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

Learning Outcomes

After completing the module the student should be able to:

Code	Description
MLO1	Solve linear, first order, constant coefficient ordinary differential equations by the method of integrating factor and apply to the modelling of engineering problems
MLO2	Solve linear, second order, constant coefficient ordinary differential equations and apply to the modelling of engineering problems
MLO3	Find first and second order partial derivatives for functions of several variables and apply to engineering problems using optimisation and errors
MLO4	Use eigenvectors and eigenvalues in the solution of engineering problems
MLO5	Solve simultaneous homogeneous ordinary differential equations with constant coefficients and apply to the solution of a two degree of freedom system
MLO6	Use Laplace transforms in the solution of engineering problems involving ordinary differential equations
MLO7	Use Fourier series in the solution of engineering problems

MLO8	Find numerical solutions of ordinary differential equations
MLO9	Apply symbolic mathematical software eg. 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 eg 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 4 CEng. 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.

Assessments

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