

Module Details	
Module Title:	Further Engineering Mathematics and Statistics
Module Code:	ENM5005-B
Academic Year:	2019-20
Credit Rating:	20
School:	Department of Mechanical and Energy Systems Engineering
Subject Area:	Engineering Mathematics
FHEQ Level:	FHEQ Level 5
Pre-requisites:	
Co-requisites:	

Contact Hours	
Type	Hours
Lectures	40
Tutorials	24
Laboratory	8
Directed Study	128

Availability	
Occurrence	Location / Period
BDA	University of Bradford / Academic Year (Sept - May)

Module Aims
To establish an appreciation and working knowledge of the premise that analytical (deterministic) and statistical tools are components of a larger integrated tool kit for addressing and evaluating multiple solutions to a variety of engineering-based problems.

Outline Syllabus
<p>Functions:</p> <ul style="list-style-type: none"> a. Special functions (Sinc, Bessel, Error, Delta). b. Multivariate functions: Partial derivatives, differentials, small increments, turning points & their classification when

applied to general & specific (chemical/civil/electrical,/ndustrial/mechanical/medical) engineering problems.

Multiple integration, change of order, change to polar coordinates, applications to general & specific (chemical/civil/electrical/industrial/mechanical/medical) engineering problems.

Linear algebra: eigenvalues and eigenvectors.

Vector calculus: grad, div, curl & associated formulas.

Laplace transforms:

- a. Standard transforms, shift theorems, transforms of derivatives & integrals;
- b. Solution of ODEs including systems;
- c. Transforms of step, delta and periodic functions, convolution.

Fourier analysis:

a. Fourier Series: Waves, representation of periodic functions by trigonometric series, half range series, complex form of the Fourier series, solutions of the two dimensional heat & wave equations.

b. Fourier transforms: periodic transforms, convolution.

Statistics:

a. The engineering method & statistical thinking; data collection & presentation; modelling random behaviour; estimation & testing; building empirical models through linear regression analysis; design of engineering experiments; introduction to response surface methodology; application to statistical quality control & life data analysis.

Specific (chemical/civil/electrical/industrial/mechanical/medical) engineering applications & context will be explored.

Learning Outcomes

1	<p>Formulate the mathematical principles for handling analytical and statistical aspects of the course of study.</p> <p>Understand variability underpinning engineering experiment, will have the knowledge required to plan & design engineering experiments to collect data, to carry out a variety of statistical tests and types of analysis on the data, to interpret the results, and to develop and validate theoretical and empirical models of engineering processes.</p>
2	<p>Apply a range of mathematical and statistical techniques to the formulation and solution of general and specific (chemical, civil, electrical, industrial, mechanical, medical) engineering problems.</p> <p>Apply a range of statistical tests to engineering data, use statistical modelling techniques to derive empirical models for engineering systems, apply statistical models to process control, and utilise a specialised software package.</p>
3	<p>Use mathematical and statistical methods for systematic problem solving.</p> <p>Use a range of advanced transferable skills in mathematical model development and statistical data presentation and interpretation.</p>

Learning, Teaching and Assessment Strategy

Knowledge (theory, calculation methodology, application, interpretation) is disseminated in lectures and is practiced in exercise classes, with further practice and both general and specific (chemical, civil, electrical, industrial, mechanical, medical) engineering context being established in discipline tutorial groups.

Statistical skills are taught and practiced in computer laboratory sessions.

Oral feedback is given during computer laboratory sessions, exercise classes, and tutorial groups. Written feedback will be provided with marked in-session assessments (class test /

SEM1, coursework / SEM 2).

The assessment diet reflects module content and summative requirements:

- a. Mathematical discipline skills are assessed in a class test (supports written feedback);
- b. Statistical skills are assessed in computer laboratory sessions (supports written feedback);
- c. The wider learning outcomes of the module are assessed in a final closed-book examination.

This module satisfies the below Learning Outcomes as specified by the Accreditation of Higher Education Programmes: Third Edition (AHEP3) as published by The Engineering Council in-line with the UK Standard for Professional Engineering Competence (UK-SPEC). These outcomes specify six key areas of learning: Science and Mathematics (SM), Engineering Analysis (EA), Design (D), Economic, Legal, Social, Ethical and Environmental Context (EL), Engineering Practice (P) and Additional General Skills (G).

SM1b, SM2b, SM3b, EA1b, EA3b, D1, D3b, D5, P1, P7, P8, G1, G2.

Further details of these learning outcomes can be found at <https://www.engc.org.uk/>.

Mode of Assessment				
Type	Method	Description	Length	Weighting
Summative	Examination - closed book	Semester 2, Examination - closed book - 2hrs	2 hours	35%
Summative	Examination - closed book	Semester 1, Examination - closed book - 1hr	1 hour	25%
Summative	Classroom test	Minitab Report under examination conditions - open book		15%
Summative	Classroom test	Semester 1, Classroom Test (maths) under examination conditions - 1hr	1 hour	25%

Reading List

To access the reading list for this module, please visit <https://bradford.rl.talis.com/index.html>.

Please note:

This module descriptor has been published in advance of the academic year to which it applies. Every effort has been made to ensure that the information is accurate at the time of publication, but minor changes may occur given the interval between publishing and commencement of teaching. Upon commencement of the module, students will receive a handbook with further detail about the module and any changes will be discussed and/or communicated at this point.