UNIVERSITY of BRADFORD

Module Descriptor

Module Details	
Module Title	Further Engineering Mathematics and Statistics
Module Code	ENM5005-B
Academic Year	2020/1
Credits	20
School	Department of Mechanical and Energy Systems Engineering
Subject Area	Engineering Mathematics
FHEQ Level	FHEQ Level 5
Pre-requisites	N/A
Co-requisites	N/A

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

Availability	
Occurrence	Location / Period
BDA	University of Bradford / Academic Year

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

Functions:

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

Outcome Number	Description
01	Formulate the mathematical principles for handling analytical and statistical aspects of the course of study. 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.
02	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. 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.
03	Use mathematical and statistical methods for systematic problem solving. Use a range of advanced transferable skills in mathematical model development and statistical data presentation and interpretation.

Learning, Teaching and Assessment Strategy

Knowledge (theory, calculation methodology, application, interpretation) is disseminated in online lectures and is practiced in tutorial classes, with further practice and both general and specific (chemical, civil, electrical, industrial, mechanical, medical) engineering context being established in discipline 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 coursework assessments, both formative time-limited take-home items (with later live marking through online seminar sessions for self-marking and gap-analysis to inform self-directed additional study) and summative items. The assessment reflects module content and summative requirements: a. Mathematical discipline skills are assessed in take-home time-limited coursework items (supports feedback); b. Statistical skills are assessed in computer laboratory sessions (supports written feedback) and a final closed-book examination. This module satisfies the Learning Outcomes below 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	Coursework	Answer all 3 questions SEM1 topics 01-03	N/A	25%
Summative	Coursework	Answer all questions covering topics 04-06	N/A	25%
Summative	Examination - Open Book	Answer all questions	N/A	35%
Summative	Classroom test	Minitab Report under examination conditions - open book	N/A	15%
Formative	Coursework	Answer all questions assessments at appropriate points in module delivery with subsequent live worked solutions for self-marking and gap analysis.	N/A	N/A

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.

https://bradford.ac.uk