ES2C7-15 Engineering Mathematics and Data Analytics

21/22

Department
School of Engineering
Level
Undergraduate Level 2
Module leader
Declan Bates
Credit value
15
Module duration
10 weeks
Assessment
30% coursework, 70% exam
Study location
University of Warwick main campus, Coventry

Description

Introductory description

ES2C7-15 Engineering Mathematics and Technical Computing

Module web page

Module aims

To build on the fundamental material introduced in ES193 Engineering Mathematics and ES197 Systems Modelling, Simulation and Computation thereby ensuring that students are equipped with the necessary analytical and computational tools to tackle advanced material in modules taught in later years. To present and provide skills in the application of more advanced mathematics and systems modelling concepts that underpin all areas of the Warwick Engineering Curriculum. To develop skills in the use of MATLAB for modelling and analysis of engineering systems. To apply computational methods to the analysis and modelling of data.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be

covered. Actual sessions held may differ.

Sequences, series, limits and Taylor series.
Fourier series.
Multi-variable vector calculus
Applied linear algebra: linear matrix/vector equations and their solution (applications such as linear regression analysis, electrical circuits and fluid networks); eigenvalue/eigenvector analysis (applications such as oscillation in circuits, structural dynamics, solution of state variable models and stability analysis); multidimensional Taylor series, linearization and extrema of functions.
Fourier transforms, z-transforms.
Partial differential equations and their solution (examples to include: wave equation, diffusion equation and Laplace equation).
Data manipulation in MATLAB
Data analysis techniques: Regression, classification, PCA and design of experiments.
MATLAB as a system modelling and analysis tool.

Learning outcomes

By the end of the module, students should be able to:

- 1. Recognise and apply advanced mathematical tools and techniques to solve engineering based problems
- 2. Develop complex mathematical models of engineering systems
- 3. Solve complex engineering problems using MATLAB
- 4. Apply data analytics techniques to datasets produced by engineering processes and systems

Indicative reading list

Croft, A. and Davison, R., “Mathematics for Engineers: and MyMathLab: A Modern Interactive Approach”, 3rd Ed., Pearson, ISBN-10: 1408263238, 2010.
James, G., “Modern Engineering Mathematics : 4th edition with MyMathLab”, Pearson, ISBN-10: 027373413X, 2010.
Magrab, E.B. et al., “An Engineer's Guide to MATLAB: International Edition”, 3rd Ed. Pearson, ISBN-10: 0137039549, 2010.
Cho, MoonJung, and Wendy L. Martinez. “Statistics in Matlab: A Primer”. Vol. 22. CRC Press, 2014.
Lei, B., Xu, G., Feng, M., van der Heijden, F., Zou, Y., de Ridder, D. and Tax, D.M., 2017. “Classification, parameter estimation and state estimation: an engineering approach using MATLAB”. John Wiley & Sons.

Subject specific skills

No subject specific skills defined for this module.

Transferable skills

No transferable skills defined for this module.

Study

Study time

Type	Required
Lectures	23 sessions of 1 hour (15%)
Practical classes	4 sessions of 3 hours (8%)
Private study	115 hours (77%)
Total	150 hours

Private study description

115 hours guided independent study

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group D3

	Weighting	Study time
Laboratory Assesment	30%	
Online Examination	70%	

2 * 1 hour QMP online tests to be scheduled in same time slot with short break inbetween

~Platforms - AEP,QMP

- Online examination: No Answerbook required
- Students may use a calculator
- Engineering Data Book 8th Edition

Feedback on assessment

- Model solutions to past papers.

- Support through advice and feedback hours.
- Written feedback on marked laboratory report.
- Online feedback on computer-based formative test.
- Cohort-level feedback on final exam.

Past exam papers for ES2C7

Availability

Post-requisite modules

If you pass this module, you can take:

- ES386-15 Dynamics of Vibrating Systems

Courses

This module is Core for:

- Year 2 of UESA-H335 BEng Automotive Engineering
- Year 2 of UESA-H161 BEng Biomedical Systems Engineering
- Year 2 of UESA-H216 BEng Civil Engineering
- Year 2 of UESA-H63W BEng Electronic Engineering
- Year 2 of UESA-H113 BEng Engineering
- Year 2 of UESA-HN15 BEng Engineering Business Management
- Year 2 of UESA-HH75 BEng Manufacturing and Mechanical Engineering
- Year 2 of UESA-H315 BEng Mechanical Engineering
- Year 2 of UESA-HH35 BEng Systems Engineering
- UESA-H112 BSc Engineering
    - Year 2 of H112 Engineering
    - Year 2 of H112 Engineering
- Year 2 of UESA-HN11 BSc Engineering and Business Studies
- Year 2 of UESA-H336 MEng Automotive Engineering
- Year 2 of UESA-H163 MEng Biomedical Systems Engineering
- Year 2 of UESA-H217 MEng Civil Engineering
- Year 2 of UESA-H63X MEng Electronic Engineering
- Year 2 of UESA-H114 MEng Engineering
- Year 2 of UESA-HH76 MEng Manufacturing and Mechanical Engineering
- Year 2 of UESA-H316 MEng Mechanical Engineering
- UESA-HH31 MEng Systems Engineering
    - Year 2 of HH31 Systems Engineering
    - Year 2 of HH35 Systems Engineering
- Year 2 of UCSA-G406 Undergraduate Computer Systems Engineering
- Year 2 of UCSA-G408 Undergraduate Computer Systems Engineering
- Year 2 of UESA-H605 Undergraduate Electrical and Electronic Engineering

- Year 2 of UESA-H606 Undergraduate Electrical and Electronic Engineering MEng