

# ES2C7-15 Engineering Mathematics and Data Analytics

**20/21**

**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

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## 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.

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## 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.

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## Assessment

You must pass all assessment components to pass the module.

### Assessment group D3

|                             | Weighting | Study time | Eligible for self-certification |
|-----------------------------|-----------|------------|---------------------------------|
| <b>Assessment component</b> |           |            |                                 |
| Laboratory Assesment        | 30%       |            | No                              |

Reassessment component is the same

**Assessment component**

|                    |     |    |
|--------------------|-----|----|
| Online Examination | 70% | No |
|--------------------|-----|----|

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

~Platforms - AEP,QMP

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

Reassessment component is the same

## 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](#)

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## 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
- Year 2 of UESA-H112 BSc 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
- UESA-H316 MEng Mechanical Engineering
  - Year 2 of H315 Mechanical Engineering BEng
  - Year 2 of H316 Mechanical Engineering MEng
- 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