

# ES1A4-15 Statics and Structures

**24/25**

**Department**

School of Engineering

**Level**

Undergraduate Level 1

**Module leader**

Elia Gironacci

**Credit value**

15

**Module duration**

24 weeks

**Assessment**

30% coursework, 70% exam

**Study location**

University of Warwick main campus, Coventry

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## Description

### Introductory description

ES1A4-15 Statics and Structures

[Module web page](#)

### Module aims

The aim of this module is to build fundamental knowledge of statics and behaviour of structures. This will provide the knowledge required for further study in the design and analysis of structures from buildings to bridges, tunnels and other infrastructures. The module will increase the students' ability with mathematical analysis and in particular its application to solving problems in structures. The module will further help in developing experimental skills and awareness of health and safety issues applicable to working in a supervised laboratory.

### 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.

Part A: Equilibrium and Reactions

1. Forces
2. Moments
3. Friction
4. Hydrostatic pressure
5. Equilibrium
6. Support conditions
7. Reactions
  - Part B: Truss structures
8. Basic principles; Building with triangles
9. Method of joints
10. Method of sections
  - Part C: Statically determinate beams and frames
11. Free body diagrams
12. Internal forces and moments in statically determinate beams
13. Internal forces in statically determinate frames
  - Part D: Deformation of statically determinate beams
14. Introduction to Bending of elastic beams (elastic curve; moment-curvature relation)
15. Introduction to Bernoulli beam theory
  - Part E: Stresses and Strains
16. Stress
17. Strain
18. Stress and strain transformations
19. Principal stresses and strains in a plane
20. Mohr's circle
  - Part F: Bending, Shear and Torsion of beams
21. Stresses and strains
22. Cross-section analysis (neutral axis; second moment of area; deflection line)
  - Part G: Elastic buckling, Failure criteria (Tresca, von Mises, Mohr) and Design of structural components

The module will include laboratory exercises.

## Learning outcomes

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

- Demonstrate practical laboratory, workshop skills and critical awareness of associated health and safety issues. [C12(D)]
- Demonstrate knowledge and understanding of engineering principles, concepts and methodology necessary to solve problems related to structures under static loading. [C1(D), C2(D), C3(D)]
- Demonstrate an ability to use engineering judgment to simplify and thus model real-life engineering problems. [C1(D), C2(D), C3(D)]
- Become familiar with knowledge of mathematics and apply analytical techniques to model and solve engineering problems related to the behaviour of structures under static loading. [C1(D), C2(D), C3(D)]
- Record, interpret and professionally communicate the results of investigated practical

experiments, discussing limitations of the techniques employed. [C1(D), C12(D), C17(D)]

## Indicative reading list

Bedford, A. & Fowler, W., 2003, "Engineering Mechanics: Statics & Dynamics Principles", Prentice-Hall. ISBN 9780130082091.

Cain, J.A. & Hulse, R., 2000, "Structural Mechanics", 2nd Ed., Palgrave Macmillan. ISBN 978-0333804575

Hibbeler, R.C., 2014, "Statics and Mechanics of Materials", 4th Ed., Pearson Prentice Hall. ISBN-13: 978-0133451603.

Hibbeler, R.C., 2017, "Statics and Mechanics of Materials", 5th Ed., Pearson Prentice Hall. ISBN-13: 978-1292177915.

Krenk, S. & Høgsberg, J., 2013, "Statics and Mechanics of Structures". ISBN: 978-94-007-6112-4.

## Subject specific skills

1. Solve fundamental engineering problems using numerical and qualitative methods
2. Apply fundamental concepts to carry experiments and record results
3. Knowledge and understanding of risk issues, including health & safety, and risk assessment

## Transferable skills

1. Numeracy: apply mathematical and computational methods to communicate parameters, model and optimize solutions
2. Apply problem solving skills, information retrieval, and the effective use of general IT facilities
3. Communicate (written and oral; to technical and non-technical audiences) and work with others

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## Study

### Study time

Type	Required
Lectures	17 sessions of 1 hour (11%)
Practical classes	10 sessions of 1 hour (7%)
Other activity	13 hours (9%)
Private study	110 hours (73%)
Total	150 hours

### Private study description

110 hours guided independent learning (including VLE use and support from Employer)

## Other activity description

2 hours of online tutorials (supporting pre-reading)  
7 hours of example classes  
2 hours of revision lectures  
2x1 hour of computer-based formative test

## 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 D1

	Weighting	Study time
Written laboratory report	30%	
Written laboratory report (6 pages)		
Online Examination	70%	
QMP		
~Platforms - AEP,QMP		

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

## Feedback on assessment

- Model solutions to questions for exam preparation.
- Support through advice and feedback hours.
- Written feedback on marked laboratory report.
- Cohort-level feedback on computer-based test.
- Cohort-level feedback on written examination.

[Past exam papers for ES1A4](#)

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## **Availability**

## **Courses**

This module is Core for:

- BEng Civil and Infrastructure Engineering