ES196-15 Statics and Structures

23/24

Department
School of Engineering
Level
Undergraduate Level 1
Module leader
Elia Gironacci
Credit value
15
Module duration
10 weeks
Assessment
30% coursework, 70% exam
Study location
University of Warwick main campus, Coventry

Description

Introductory description

ES196-15 Statics and Structures

Module web page

Module aims

The aim of this module is to build fundamental knowledge of statics and behaviour of structures that underpin many branches of engineering science. This will provide the knowledge required for further study in the design and analysis of structures from buildings to spacecraft, motor vehicles and wind turbines. 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. Bending of elastic beams (elastic curve; moment-curvature relation)
15. 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 includes 4 laboratory exercises.

Learning outcomes

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

- Demonstrate knowledge and understanding of basic theory, concepts and methodology necessary to solve problems related to structures under static loading.
- Become familiar with mathematical analysis and its application to solving engineering problems related to the behaviour of structures under static loading.
- Record and interpret the results of observed practical experiments.
- Demonstrate experimental skills.
- Demonstrate awareness of health and safety issues applicable to working in a supervised laboratory.
- Demonstrate an ability to make appropriate assumptions to simplify and thus model real-life engineering problems.

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	30 sessions of 1 hour (20%)
Practical classes	10 sessions of 1 hour (7%)
Other activity	12 hours (8%)
Private study	98 hours (65%)
Total	150 hours

Private study description

98 hours of guided independent learning

Other activity description

8 x 1hr = 8 hours of examples classes
2 x 1hr = 2 hours computer-based formative test
2 x 1hr = 2 hours revision lectures

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group D4

	Weighting	Study time
Written laboratory report Written report (10 pages in length)	30%	
Online Examination QMP ~Platforms - AEP,QMP	70%	

- 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 office hours.
- Written feedback on marked laboratory report.
- Cohort-level feedback on computer-based formative test.
- Cohort-level feedback on final exam.

Past exam papers for ES196

Availability

Courses

This module is Core for:

- Year 1 of UESA-H335 BEng Automotive Engineering
- Year 1 of UESA-H161 BEng Biomedical Systems Engineering
- Year 1 of UESA-H216 BEng Civil Engineering
- Year 1 of UESA-H63W BEng Electronic Engineering
- Year 1 of UESA-H113 BEng Engineering
- Year 1 of UESA-HN15 BEng Engineering Business Management
- Year 1 of UESA-HH75 BEng Manufacturing and Mechanical Engineering
- Year 1 of UESA-H315 BEng Mechanical Engineering
- Year 1 of UESA-HH35 BEng Systems Engineering
- Year 1 of UESA-HN11 BSc Engineering and Business Studies
- Year 1 of UESA-H336 MEng Automotive Engineering
- Year 1 of UESA-H163 MEng Biomedical Systems Engineering
- Year 1 of UESA-H217 MEng Civil Engineering
- Year 1 of UESA-H63X MEng Electronic Engineering
- Year 1 of UESA-H114 MEng Engineering
- Year 1 of UESA-HH76 MEng Manufacturing and Mechanical Engineering
- Year 1 of UESA-H316 MEng Mechanical Engineering
- UESA-HH31 MEng Systems Engineering
    - Year 1 of HH31 Systems Engineering
    - Year 1 of HH35 Systems Engineering
- Year 1 of UESA-H605 Undergraduate Electrical and Electronic Engineering
- Year 1 of UESA-H606 Undergraduate Electrical and Electronic Engineering MEng