ES1A5-15 Statics and Dynamics

21/22

Department
School of Engineering
Level
Undergraduate Level 1
Module leader
Mohammad Al-Amin
Credit value
15
Module duration
24 weeks
Assessment
50% coursework, 50% exam
Study location
University of Warwick main campus, Coventry

Description

Introductory description

The aim of this module is to build fundamental knowledge of statics, the behaviour of structures and dynamic mechanical systems.

Module aims

This module provides the knowledge required for further study in the design and analysis of structures and the dynamic behaviour of particles and rigid bodies that are appropriate for Electro-mechanical applications. The module will increase the students' ability with mathematical analysis and in particular its application to general problem-solving. 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.

1. Forces
2. Moments
3. Friction

4. Hydrostatic pressure
5. Equilibrium
6. Support conditions, Reactions
7. Method of joints
8. Method of sections Part C: Statically determinate beams and frames
9. Free body diagrams
10. Internal forces and moments in statically determinate beams
11. Part D: Deformation of statically determinate beams
12. Bending of elastic beams (elastic curve; moment-curvature relation)
13. Bernoulli beam theory Part E: Stresses and Strains
14. Stress
15. Strain
16. Stress and strain transformations
17. Stresses and strains (normal, shear, bending)
18. 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
19. Fundamental laws governing dynamics: gravitational attraction, Newton’s laws;
20. Kinematic analysis in 1-D and 2-D covering both linear and angular systems and examples of their application, to include the Cartesian, polar and path form of the velocity and acceleration vector
21. Kinetics of 1-D systems including examples with variable acceleration, concept of conservative forces

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 static loading problems
- Record and interpret the results of observed practical experiments
- To understand the basic principles that operate in dynamic mechanical systems, and to achieve an understanding of Kinematics in 1-D and 2-D space
- To achieve an understanding of Kinetics in 1-D and 2-D space and their application to particles and rigid bodies
- To develop 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.

Krenk, S. & HØgsberg, J., 2013, “Statics and Mechanics of Structures”. ISBN: 978-94-007-6112-4.
F. Beer and E. Russell Johnston Jr., Vector Mechanics for Engineers: Dynamics (2009).
R. C. Hibbeler, Engineering Mechanics: Dynamics (2012).
A. M. Bedford, Engineering Mechanics: Dynamics (2007).

Subject specific skills

Communicate technical information with others at all levels, including technical reports and the use of digital tools.
Follow a methodical approach to engineering problem solving.
Model real-world mechanical systems efficiently.
Perform risk management for engineering activities.
Comply with statutory and organisational safety requirements.

Transferable skills

Hold paramount the health and safety of themselves and others, and model health and safety conscious behaviour.
Self-motivated, work independently and take responsibility for their actions. Set themselves challenging personal targets and make own decisions.
Communicate confidently to create and maintain working relationships. Be respectful.
Work collaboratively as a team player. Able to work effectively within a team and interact with /help others when required.
Prioritise quality. Follow rules, procedures and principles in ensuring work completed is fit for purpose, and pay attention to detail / error checks throughout activities.
Adjust to different conditions, technologies, situations and environments and to new and emerging technologies.
Commit to personal learning and professional development.
Commit to professional standards (or codes of conduct) of their employer and the wider industry.

Study

Study time

Type	Required
Lectures	22 sessions of 1 hour (15%)
Seminars	(0%)
Tutorials	8 sessions of 1 hour (5%)
Supervised practical classes	3 sessions of 3 hours (6%)
Work-based learning	50 sessions of 1 hour (33%)
Online learning (scheduled sessions)	(0%)
Online learning (independent)	1 session of 1 hour (1%)
Total	150 hours

Type	Required
Private study	60 hours (40%)
Total	150 hours

Private study description

60 hours guided independent learning (including VLE use).

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group C

	Weighting	Study time
Laboratory Report 6 page report	30%	
Test	20%	
Online Examination 1 * 1 hour QMP ~Platforms - AEP,QMP	50%	

- Online examination: No Answerbook required
- Engineering Data Book 8th Edition

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 ES1A5

Availability

Courses

This module is Core for:

- Year 1 of DESA-H360 Undergraduate Electromechanical Engineering (Degree Apprenticeship)