

ES190-15 Dynamics and Thermodynamics

24/25

Department

School of Engineering

Level

Undergraduate Level 1

Module leader

Peter Brommer

Credit value

15

Module duration

10 weeks

Assessment

30% coursework, 70% exam

Study location

University of Warwick main campus, Coventry

Description

Introductory description

This module is designed to provide all School of Engineering students a foundation on which to build further study of bodies in motion and thermodynamics as applied to any engineering discipline.

[Module web page](#)

Module aims

To present the fundamental concepts of dynamic mechanical systems and the nature of thermodynamic systems that underpin many branches of engineering science.

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.

The module is divided into two themes:

(A) Dynamics

- Ai. Fundamental laws governing dynamics: gravitational attraction, Newton's laws;
- Aii. 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;
- Aiii. Kinetics of 1-D and 2-D systems including examples with variable acceleration, concept of conservative forces;
- Aiv. Alternative dynamic analysis methods: impulse-momentum and energy methods and examples of their application.

(B) Thermodynamics

- Bi. Introductory thermodynamics (concepts, work, heat, temperature);
- Bii. Energy storage and working fluids (energy storage, ideal gases, condensable fluids);
- Biii: Heat transfer (conduction, convection, radiation) and heat exchangers;
- Biv: The First Law, measures of thermodynamic performance, the steady-flow energy equation, and basic engine cycles;
- Bv: The Second Law, entropy, and the Carnot cycle.

The module also includes 2 laboratory exercises.

Learning outcomes

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

- Dynamic Mechanics: 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 using Cartesian, polar and path co-ordinate systems. [C1(D), C2(D), M1(D), M2(D)]
- Dynamic Mechanics: To be able to quantify Kinetic problems in 1-D and 2-D, with some applications considering variable acceleration. [C1(D), C2(D), M1(D), M2(D)]
- Dynamic Mechanics: To appreciate impulse-momentum and energy methods and their application to quantify dynamic engineering systems. [C1(D), C2(D), M1(D), M2(D)]
- Thermodynamics: To develop an understanding of the thermodynamic properties of systems and the nature of heat, and to apply this knowledge. [C1(D), C2(D), M1(D), M2(D)]
- Thermodynamics: To gain an understanding of the First Law of Thermodynamics, and to apply this to closed and open systems. [C1(D), C2(D), M1(D), M2(D)]
- Thermodynamics: To gain an understanding of the Second Law of Thermodynamics and entropy, and to apply this knowledge. [C1(D), C2(D), M1(D), M2(D)]
- Laboratories: To develop laboratory and data analysis skills, including an ability to make appropriate assumptions to simplify real-life Engineering problems. [C12(D), C17(D), M12(D), M17(D)]

Indicative reading list

For Dynamics :

- (1) F. Beer and E. Russell Johnston Jr., Vector Mechanics for Engineers: Dynamics (2009).
- (2) R. C. Hibbeler, Engineering Mechanics: Dynamics (2012).

(3) A. M. Bedford, Engineering Mechanics: Dynamics (2007).

For Thermodynamics :

(1) "Thermodynamics for Engineers, Third Edition" by M.C. Potter, C.W. Somerton, Schaum's Outlines, 2014, ISBN: 978-0-07-183082-9.

(2) "Basic Engineering Thermodynamics" by P.B. Whalley, Oxford University Press, 1992, ISBN: 978-0-1985-6255-9.

(3) "Equilibrium Thermodynamics, Third Edition" by C.J. Adkins, Cambridge University Press, 1982, ISBN: 978-0-5212-7456-2.

[View reading list on Talis Aspire](#)

Subject specific skills

SM1p Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies.

SM2p Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems.

EA1p Understanding of engineering principles and the ability to apply them to analyse key engineering processes.

D6p Communicate their work to technical and non-technical audiences.

ET6p Knowledge and understanding of risk issues, including health & safety, environmental and commercial risk, and of risk assessment and risk management techniques.

EP3p Ability to apply relevant practical and laboratory skills

EP8p Ability to work with technical uncertainty

Transferable skills

Appreciate the importance of concepts such as motion, forces, energy, heat transfer in everyday life.

Write concise reports of technical events.

Apply mathematical and computational methods to find answers.

Apply problem solving skills in the search for unknown quantities.

Study

Study time

Type	Required
Lectures	30 sessions of 1 hour (20%)
Practical classes	2 sessions of 3 hours (4%)
Other activity	11 hours (7%)
Private study	103 hours (69%)
Total	150 hours

Private study description

- 103 hours of guided independent learning

Other activity description

- 4 hours of examples lectures
- 1 computer-based formative test
- 4 hours revision lectures
- 1 hour laboratory briefings
- 1 hour laboratory feedback

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Students can register for this module without taking any assessment.

Assessment group D8

	Weighting	Study time
Inertia Laboratory Assessment and Energy Balance Laboratory Assessment	30%	
Laboratory assignment - equivalent to 6 pages		
Online Examination	70%	
2 hour QMP online tests, Answer book required.		

~Platforms - AEP,QMP

- Online examination: No Answerbook required
- Engineering Data Book 8th Edition
- Thermodynamic and Transport Properties of Fluids (ES4D90)

Feedback on assessment

- Model solutions to specimen papers.
- Support through advice and feedback hours.
- Feedback on marked laboratory assignments.
- Feedback on computer-based formative test (Dynamics).
- Cohort-level feedback on final exam.

[Past exam papers for ES190](#)

Availability

Post-requisite modules

If you pass this module, you can take:

- ES4G3-15 Dynamics of 3D Mechanical Systems

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