ES1A7-15 Thermodynamics and Fluid Mechanics

26/27

Department
School of Engineering
Level
Undergraduate Level 1
Module leader
Angeles Rivero Pacho
Credit value
15
Module duration
24 weeks
Assessment
100% exam
Study location
University of Warwick main campus, Coventry

Description

Introductory description

This module is designed to provide the fundamental concepts of thermodynamics and fluid mechanics that underpin many branches of engineering science.

Module aims

The principal aims of the module are to develop a firm understanding of key mechanical engineering concepts, specifically the foundations of thermodynamics and fluid mechanics.

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.

(A) Thermodynamics

- Ai. Thermodynamic Properties
- Aii: The First Law

- Aiii: The Second Law
- Aiv: Heat Transfer and Heat Exchangers

(B) Fluid Mechanics

- Bi. Viscosity: real and inviscid fluids
- Bii. Pressure and its measurement (manometers)
- Biii. Reynolds number: laminar and turbulent flow
- Biv. Conservation of mass and momentum (the continuity and momentum equations)
- Bv. Application of Bernoulli's equation
- Bvi. Model testing, dimensional analysis, and drag coefficients
- Bvii. Laminar and turbulent flows; pipe flows, surface roughness, Moody Chart
- Bviii. Compressibility effects
- Bix. The role of pressure in fluid mechanics and the 1-D wave equation for an acoustic wave.

The module also includes two laboratory exercises (Energy Balance and Wind Tunnel).

Learning outcomes

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

- Understand the thermodynamic properties of systems, including the nature of heat, and apply this knowledge.
- Understand the 1st Law of Thermodynamics and its application to open and closed systems.
- Understand the 2nd Law of Thermodynamics (including the concept of entropy) and apply this knowledge to basic Thermodynamic systems.
- Demonstrate knowledge and understanding of the well-established equations of fluid mechanics and to be able to classify different types of flow regime and fluid behaviour using appropriate dimensionless numbers.
- Apply Bernoulli’s principle to a range of applications to predict inviscid fluid-flow behaviour, while being able to identify its limitations.
- Show appreciation for extensions to fluid mechanics theory, e.g. compressibility, surface tension.
- Analyse experimental measurements of flow rates, temperature, velocity and pressure, and be able to quantify and analyse the various forms of error.

Indicative reading list

Reading lists can be found in Talis

Subject specific skills

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.

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.

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

Communicate their work to technical and non-technical audiences.

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

Ability to apply relevant practical and laboratory skills

Comply with statutory and organisational safety requirements.

Transferable skills

Appreciate the importance of concepts such as fluid flow, 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	20 sessions of 1 hour (13%)
Seminars	2 sessions of 2 hours (3%)
Supervised practical classes	2 sessions of 2 hours (3%)
Work-based learning	32 sessions of 1 hour (21%)
Other activity	4 hours (3%)
Private study	86 hours (57%)
Total	150 hours

Private study description

86 hours guided independent learning (including VLE use).

Other activity description

Revision sessions prior to exams

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group B

Assessment component	Weighting	Study time	Eligible for self-certification
Centrally-timetabled examination (On-campus)	100%		No

Available in the exam: Engineering data book 9th edition, Thermodynamic and transport properties of fluids, Answer booklet.

- Students may use a calculator
- Thermodynamic and Transport Properties of Fluids (ES4D90)
- Answerbook Green (8 page)
- Engineering Data Book 8th Edition

Reassessment component is the same

Feedback on assessment

Model solutions to questions for exam preparation.
Support through advice and feedback hours.
Cohort-level feedback on written examination.

Past exam papers for ES1A7

Availability

Courses

Course availability information is based on the current academic year, so it may change.
This module is Core for:

- Year 2 of DESA-H360 Undergraduate Electromechanical Engineering (Degree Apprenticeship)