WM293-15 Engineering Thermofluids

25/26

Department
WMG
Level
Undergraduate Level 2
Module leader
Jane Rayner
Credit value
15
Module duration
14 weeks
Assessment
Multiple
Study locations
University of Warwick main campus, Coventry Primary
Distance or Online Delivery

Description

Introductory description

This module provides the fundamental knowledge of thermodynamics principles, fluid mechanics and heat transfer needed by all engineering disciplines relevant to Degree Apprenticeship Standards ST0023, ST0024, ST0025 and ST0027. Students will learn the relevant theories and will be able to apply them to solve engineering problems. They will also be able to apply subject knowledge in a real-world scenario, analyse and present the results.

This module is linked with C1, C2, C12, C16 and C17 and of the AHEP 4.

LO1 - C1, C2, C12, C16
LO2 - C1, C2, C12, C16
LO3 - C1, C2
LO4 - C1, C2
LO5 - C16
LO6 - C17

Module web page

Module aims

This module is aligned to the engineering mathematics, electrical/electronic systems and design module in order to deliver a holistic learning experience. As fundamental subjects in engineering context, the intention of this module is to give an overview of different concepts in engineering thermofluids and how to employ them in order to solve engineering problems. Students need to understand fundamental thermodynamic laws and principles and develop their problem solving skills enabling study of engineering problems by mathematical, physical and analytical approaches.

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.

Thermodynamics
Energy transfer by heat and work
Thermodynamic laws
Thermodynamic processes - isothermal, isobaric, isochoric, adiabatic, polytropic, isentropic
Thermodynamic cycles – Carnot, Otto, Diesel, Refrigeration

Fluid Mechanics
Basic dimensional analysis, non-dimensional numbers
Fluid mechanics basic concepts
Viscosity, continuity, Newtonian fluids
Laminar and turbulent flow, Reynolds number
Flow measurement, pitot tube, venturi/orifice meter
Pressure loss in pipe systems, Moody chart

Heat Transfer
Modes of heat transfer – conduction, convection, radiation
Steady state heat transfer, thermal resistance, heat transfer networks
Transient heat transfer, lumped body analysis, Heisler charts, significance of Biot number
Understanding influence of fluid flow on convection through Nusselt number
Using numerical methods to analyse 1D and 2D heat transfer problems

Learning outcomes

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

- Analyse thermodynamic systems using principles of thermodynamics relevant to engineering [AHEP:4-C1, C2, C12, C16]
- Describe and apply the basic concepts of fluid mechanics [AHEP:4-C1, C2, C12, C16]
- Describe and apply thermodynamic principles to steady-state and transient heat transfer problems [AHEP:4-C1, C2]
- Select and apply appropriate computational and analytical techniques to model heat transfer problems [AHEP:4-C1, C2]
- Demonstrate the ability to function effectively as an individual, and as a member or leader of a team. [AHEP:4 - C16]
- Communicate effectively on engineering matters using different written formats. [AHEP:4 -

C17]

Indicative reading list

Reading lists can be found in Talis

Specific reading list for the module

Subject specific skills

1. Collate and use a range of data sources and supporting documentation to support projects (S3 ST0027, S3 ST0025).
2. Observe, record and draw accurate and auditable conclusions from data or developmental or test evidence (S5 ST0027, S5 ST0025).
3. Demonstrate leadership when undertaking product design, development, modification, or updating engineering activities (S10 ST0027).
4. Evaluate engineering designs, development or modification options (S13 ST0027).
5. Comply with statutory and organisational safety standards and requirements, supporting safety risk assessments and mitigate any risks identified within the design, manufacture, development or test activity (S7 ST0027, S8 ST0025)

Transferable skills

Problem solving - Use rational and logical reasoning to deduce appropriate and well-reasoned conclusions. Retain an open mind, optimistic of finding solutions, thinking laterally and creatively to look beyond the obvious. Knows how to learn from failure.
Communication - Present arguments, knowledge and ideas, in a range of formats. Active listening: questioning, reflecting, summarising.
Teamwork - Operate within, and contribute to, a respectful, supportive and cooperative group climate. Sensitive to the impact of actions on others.
Digital literacy - Has the capabilities that enable living, learning and working in a digital society. Comfortable with using digital media to communicate, solve problems, manage information, collaborate, create and share content.
Professionalism - Prepared to operate autonomously. Aware of how to be efficient and resilient. Manages priorities and time. Self-motivated, setting and achieving goals, prioritising tasks.
Critical Thinking - Recognise patterns, themes and key messages from sometimes confused and incomplete data. Make informed decisions on the value of a range of sources allowing an evidence based conclusion based on this analysis.

Study

Study time

Type	Required
Lectures	8 sessions of 1 hour (5%)
Seminars	10 sessions of 1 hour (7%)
Practical classes	4 sessions of 1 hour (3%)
Online learning (scheduled sessions)	8 sessions of 1 hour (5%)
Online learning (independent)	10 sessions of 1 hour (7%)
Private study	50 hours (33%)
Assessment	60 hours (40%)
Total	150 hours

Private study description

Pre-delivery revision (e.g. Math skills)
Watching videos
Online quiz
Additional questions on the subject matter.

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group A

	Weighting	Study time	Eligible for self-certification
Two posters based on lab activities	40%	24 hours	No

Students will work in groups of 6 and will make two A2 posters on the lab activities.
Will be subjected to peer-marking in line with the WMG policy.

Students who do not attend the lab sessions in the prescribed teaching block will be given an opportunity to execute the labs at a later date and produce posters .

Heat Transfer Analysis Using Numerical Methods	60%	36 hours	Yes (extension)

Students will complete an individual report based on 1D, 2D, steady state and transient heat transfer problems which they will solve using numerical methods.

Assessment group R

	Weighting	Study time	Eligible for self-certification
Two posters based on lab activities	40%	24 hours	No
Heat Transfer Analysis Using Numerical Methods	60%	36 hours	No

Feedback on assessment

Formative verbal feedback during seminar and lab sessions
Formative feedback through online support

Written group summative feedback on assessment 1 (posters based on lab activity)
Written individual summative feedback assessment 2 (individual written report)

Availability

Courses

This module is Core for:

- Year 2 of DWMS-H7C7 Undergraduate Applied Professional Engineering (Control/Technical Support Engineer) (Degree Apprenticeship)
- Year 2 of DWMS-H7C6 Undergraduate Applied Professional Engineering (Electrical/Electronic Support Engineer) (Degree Apprenticeship)
- Year 2 of DWMS-H7C5 Undergraduate Applied Professional Engineering (Manufacturing Engineer) (Degree Apprenticeship)
- Year 2 of DWMS-H7C8 Undergraduate Applied Professional Engineering (Product Design and Development Engineer) (Degree Apprenticeship)