Module Specification

Applied Thermofluids

Version: 2021-22, v1.0, 13 Jul 2020

Contents

Part 1: Information

Module title: Applied Thermofluids

Module code: UFMFTS-30-2

Level: Level 5

For implementation from: 2021-22

UWE credit rating: 30

ECTS credit rating: 15

Faculty: Faculty of Environment & Technology

Department: FET Dept of Engineering Design & Mathematics

Partner institutions: None

Delivery locations: City of Bristol College, Frenchay Campus, University Centre Somerset, University Centre Weston

Field: Engineering, Design and Mathematics

Module type: Standard

Pre-requisites: None

Excluded combinations: None

Co-requisites: None

Continuing professional development: No

Professional, statutory or regulatory body requirements: None

Part 2: Description

Overview: This module builds on the fundamentals covered in Thermofluids. to further develop the students' understanding of thermodynamics and fluid dynamics with an emphasis on real world problems.

In the first part of the module the students' toolbox of solving thermofluid problems is

greatly expanded, so that they can tackle industry type problems. Students will move from steady, incompressible isothermal flows to more realistic complex problems.

In the second part of the module, Computational Fluid Dynamics (CFD) will be introduced as an analysis tool to solve complex problems. The theory underpinning CFD is not neglected, but is presented in a trimmed down way in order to allow students to appreciate and quantify the approximations and hypotheses the method uses.

Features: Not applicable

Educational aims: The aim of this module is to develop specific technical knowledge necessary for the study of fluid dynamics and thermodynamics involving computational methods of solution.

Outline syllabus: Outline Syllabus:
Second Law of Thermodynamics
Steady Flow Energy Equation (SFEE)
Steady-flow Vapour and Gas Processes
Thermodynamic Cycles
Fluid Flow - Laminar, Turbulent and with Friction
Applied Fluid Flow - Machines, Flow Measurement and Momentum Compressible Flow
Combustion and Emissions
Dimensional Analysis
Navier-Stokes Equation and CFD

Part 3: Teaching and learning methods

Teaching and learning methods: The module adopts an interactive approach to student learning through lectorials.

In the first instance the students will conduct hands-on laboratory experiments to observe theory in action. The students are encouraged to think about the underlying physical phenomena that could explain their observations, promotive self-learning.

The ideas developed by the student are challenged in an interactive lectorial with quizzes for formative feedback.

Reflective practice is encouraged throughout the module where students are working in groups to allow them to share and discuss any aspects or challenges that the module may bring to light. In all instances the relevance of the experiment and theory will be contextualised to real engineering problems.

Students will learn CFD though self-paced tutorials, backed-up with Lecture-led tutorial sessions. A common problem will be used to help reinforce the interconnectivity between CFD and thermofluids.

Module Learning outcomes: On successful completion of this module students will achieve the following learning outcomes.

MO1 Apply mathematical and computational models to problems in fluid dynamics and thermodynamics problems with regard to underlying assumptions and limitations. (SM2b, SM5m) On successful completion of this module students will achieve the following learning outcomes.

MO2 Apply and explain thermofluid engineering principles and the ability to apply them to analyse key engineering processes (EA1b, SM1m) On successful completion of this module students will achieve the following learning outcomes.

MO3 Identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques (EA2) On successful completion of this module students will achieve the following learning outcomes.

MO4 Work with information that may be incomplete or uncertain and to quantify the effect of this on the design and mitigate deficiencies using thermofluid theory or experimental research. (D3m, P8)

Hours to be allocated: 300

Contact hours:

Independent study/self-guided study = 114 hours

Face-to-face learning = 36 hours

Total = 150

Reading list: The reading list for this module can be accessed at readinglists.uwe.ac.uk via the following link https://rl.talis.com/3/uwe/lists/A9319946-BFF1-A9B8-AFBD-471D062EC762.html?lang=en-US&login=1

Part 4: Assessment

Assessment strategy: The module will assess thermofluid principles, data collection and analysis skills. Students will also use simulations to solve more complex problems. The assessment strategy covers each of these aspects.

Component A consists of two elements:

The first is a series of short e-assessments (circa 30 minutes) to test the practical application of the underpinning theory.

During the first teaching block the students will collect data from a series of lab practicals. The data will be used in both components, half the data will be used to validate the modelling in component B.

The other half of the data will be used in a practical skills assessment. In this 90 minute assessment, under controlled conditions, students will will need to process the data from the labs and answer additional related questions.

Component B will involve students working in small groups (typically pairs) using CFD to model a fluid flow problem.

The report produced should demonstrate: - Proficiency in using CFD software, including understanding of the limitations of the software and validity of their results. The students will need to validate their models with data collected from practicals.

Resit strategy:

The resit strategy will be the same as the first sit. With the exception that experimental data will be provided, since the students may not have collected their own

Assessment components:

Practical Skills Assessment - Component A (First Sit)
Description: Controlled conditions PC lab exam using experimental data alongside some standard questions (90 minutes)
Weighting: 45 %
Final assessment: No
Group work: No
Learning outcomes tested: MO2, MO4

Online Assignment - Component A (First Sit)
Description: A series of e-assessments
3 tests (approx 30 minutes) every 4 weeks
Weighting: 10 %
Final assessment: No
Group work: No
Learning outcomes tested: MO1, MO2, MO3

Report - Component B (First Sit)
Description: Students working in small groups using CFD to model a fluid flow problem. The report produced should demonstrate: - Proficiency in using CFD software, including understanding of the limitations of the software and validity of their results - Integrating fluid dynamic, thermodynamic and propulsion problems (3000 words)
Weighting: 45 %
Final assessment: No
Group work: Yes
Learning outcomes tested: MO1, MO3

Practical Skills Assessment - Component A (Resit)
Description: Controlled conditions PC lab exam using experimental data alongside some standard questions (90 minutes)
Weighting: 45 %
Final assessment: Yes
Group work: No
Learning outcomes tested: MO2, MO4

Online Assignment - Component A (Resit)
Description: e-assessments
Weighting: 10 %
Final assessment: No
Group work: No
Learning outcomes tested: MO1, MO2, MO3

Report - Component B (Resit)
Description: Individual report to demonstrate: - Proficiency in using CFD software, inclcuding understanding of the limitations of the software and validity of their results - Integrating fluid dynamic, thermodynamic and propulsion problems (1500 words).
Weighting: 45 %
Final assessment: No
Group work: No
Learning outcomes tested: MO1, MO2, MO3

Part 5: Contributes towards

This module contributes towards the following programmes of study:

Mechanical Engineering {Apprenticeship-UCW} [Sep][FT][UCW][3yrs] FdSc 2020-21

Automotive Engineering [Sep][SW][Frenchay][4yrs] BEng (Hons) 2020-21

Mechanical Engineering [Sep][FT][Frenchay][4yrs] MEng 2020-21

Automotive Engineering [Sep][FT][Frenchay][4yrs] MEng 2020-21

Mechanical Engineering [Sep][SW][Frenchay][5yrs] MEng 2020-21

Mechanical Engineering [Sep][FT][Frenchay][3yrs] BEng (Hons) 2020-21

Mechanical Engineering [Sep][SW][Frenchay][4yrs] BEng (Hons) 2020-21

Automotive Engineering [Sep][SW][Frenchay][5yrs] MEng 2020-21

Automotive Engineering [Sep][FT][Frenchay][3yrs] BEng (Hons) 2020-21

Mechanical Engineering {Apprenticeship-UCS} [Sep][FT][UCS][3yrs] FdSc 2020-21