Module Specification

Advanced Aerodynamics

Version: 2023-24, v2.0, 23 Mar 2023

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Part 1: Information

Module title: Advanced Aerodynamics

Module code: UFMFBV-15-M

Level: Level 7

For implementation from: 2023-24

UWE credit rating: 15

ECTS credit rating: 7.5

Faculty: Faculty of Environment & Technology

Department: FET Dept of Engineering Design & Mathematics

Partner institutions: None

Field:

Module type: Module

Pre-requisites: Fundamental Aerodynamics 2021-22

Excluded combinations: None

Co-requisites: None

Continuing professional development: No

Professional, statutory or regulatory body requirements: None

Part 2: Description

Overview: This module provides a detailed overview of advanced aerodynamics using illustrated practical examples and computational exercises to help students gain a true feel for aerodynamic flow. The methods used have been tried and tested by the industrial and academic community in practice. The module continues the development of aerodynamics taught at previous levels.

The module content covers theoretical and practical aspects of time dependent flows

with applications to fixed wing aircraft, helicopters, projectiles, fuel tanks and Unmanned Aerial Vehicles are studied.

All flow regimes from subsonic through to hypersonic are studied.

Features: Not applicable

Educational aims: The aim of this module is to provide advanced knowledge and understanding on the aerodynamic design and performance of aerial vehicles and brings together, scientific, engineering design and mathematical concepts covered at an earlier stage in the programme.

Outline syllabus: In this module will be covered:

Review of the basic laws,

Time dependent and oscillating flows of aerodynamics flows,

CFD methods for time-dependent flows,

Unsteady boundary layer flow and separation,

High speed aerodynamics including hypersonics, supersonic projectiles methods and jet flows,

Oscillating flow in pipes and tanks,

Rotating flows for rotorcraft, and wind-turbines,

Aeroelastic flutter, buffet and gallop.

Part 3: Teaching and learning methods

Teaching and learning methods: The module delivery is designed to support students in producing useful predictions of flow behaviour in realistic aerospace

scenarios.

To achieve this objective the aerodynamic methods will be presented in lectures to inform and make clear the connection between theory and practice. The material will be discussed and practised in tutorial sessions and simulation labs.

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

MO1 Apply aerodynamic theory to subsonic, transonic, supersonic and hypersonic flows (SM1m, D3m, P8m).

MO2 Implement numerical methods to produce simulations of aerodynamic flows in time varying cases (SM5m, EA3m, D3m, P8m).

MO3 Research academic and professional literature and synthesise relevant ideas and methods for unsteady flows (P4m).

MO4 Build mathematical models which can describe unsteady flow behaviour (SM1m, EA1m, EA6m).

Hours to be allocated: 150

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/461FA677-AB6B-0D80-231D-0193F0FB97C2.html?lang=en-GB

Part 4: Assessment

Assessment strategy: The module will be assessed in two tasks to ensure that the theoretical and application aspects if the content can be appropriately assessed.

A three hour open book exam on time dependent aerodynamics to test student understanding of theoretical knowledge, method selection, mathematical model development, and calculation skills.

A computational fluid dynamics (CFD) assignment on a time dependent flow in a multiphysics environment. The assignment gives students experience in a multiphysics environment before taking this further in a subsequent module.

The resit assessment will have the same format as the first sit.

Assessment tasks:

Examination (First Sit)
Description: Written examination (3 hours)
Weighting: 75 %
Final assessment: Yes
Group work: No
Learning outcomes tested: MO1, MO2, MO3, MO4

Portfolio (First Sit)
Description: 2000 word written report with supporting material
Weighting: 25 %
Final assessment: No
Group work: No
Learning outcomes tested: MO1, MO2, MO4

Examination (Resit)
Description: Written examination (3 hours)
Weighting: 75 %
Final assessment: No
Group work: No
Learning outcomes tested: MO1, MO2, MO3, MO4

Portfolio (Resit)

Description: 2000 word written report with supporting material

Weighting: 25 %

Final assessment: No

Group work: No

Learning outcomes tested: MO1, MO2, MO4

Part 5: Contributes towards

This module contributes towards the following programmes of study:

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

Aerospace Engineering with Pilot Studies [Sep][FT][Frenchay][4yrs] MEng 2020-21