UNIVERSITY of BRADFORD

Module Descriptor

Module Details	
Module Title	Advanced Fluid Mechanics with Aerodynamics
Module Code	MAE6013-B
Academic Year	2020/1
Credits	20
School	Department of Mechanical and Energy Systems Engineering
Subject Area	Mechanical and Automotive Engineering
FHEQ Level	FHEQ Level 6
Pre-requisites	N/A
Co-requisites	N/A

Contact Hours	
Type	Hours
Laboratories	4
Lectures	30
Lectures	18
Directed Study	148

Availability	
Occurrence	Location / Period
BDA	University of Bradford / Semester 2

Module Aims

To examine the principles of fluid flow relevant to a wide range of industries. To qualify and quantify the effects of these internal and external flows upon the flight of airplanes, the performance of ground vehicles and industrially engineering machinery.
To gain experience in the use of proprietary Computational Fluid Dynamics (CFD) software for a wide range of industrial problems.

Outline Syllabus

Fluid properties and flow properties - static and dynamic pressure;
Types of fluid flow - laminar, transitional and turbulent, viscous and inviscid;
Mass continuity, energy equations, momentum (Euler and Navier-Stokes) equations and their applications;
Shear bounded flows - the boundary layer, pipe flows;
Free shear flows - jets, wakes, mixing layers;
External and internal incompressible and compressible flow;
Aerodynamic forces - lift, drag - pressure, skin friction, induced drag;
Aerodynamic axis systems and moments;
Attached and separated flow, pressure coefficients, angle of attack;
Ground vehicle aerodynamics: ground effects, under body channels, diffusers, spoilers, other typical examples of aerodynamics from real life case studies;
Propulsion systems - propellors, turbojets, turbofans, ram and scramjets;
Machines for renewable energy - wind turbines, wave machines and tidal power;
Computational Fluid Dynamics (CFD) applied to internal and external flows both for incompressible and compressible flows.

Learning Outcomes

Outcome Number	Description
01	Understand the application of theories of Newtonian fluid mechanics; both viscous and inviscid, and incompressible and compressible, to real world applications in the aeronautics, automotive and other industries.
02	Quantify fluid dynamical forces and understand their influence on performance within a wide range of industrial applications.
03	Interpret and justify numerical experimental data by using available information and propose solutions to problems arising from that analysis.

Learning, Teaching and Assessment Strategy

Theoretical understanding and problem solving through on-line lectures, staff-led tutorial/example classes, numerical experiments and directed study. Practical skills of data interpretation and justification gained from CFD sessions.
Assessed by examination and numerical laboratory report.

This module satisfies the following Learning Outcomes as specified by the Accreditation of Higher Education Programmes: Third Edition (AHEP3) as published by The Engineering Council in-line with the UK Standard for Professional Engineering Competence (UK-SPEC). These outcomes specify six key areas of learning: Science and Mathematics (SM), Engineering Analysis (EA), Design (D), Economic, Legal, Social, Ethical and Environmental Context (EL), Engineering Practice (P) and Additional General Skills (G).
SM1b, SM2b, SM3b, EA1b, EA2, EA3b, EA4b, D3b, P1, P2, P3, G1, SM1m, SM2m, SM5m, EA1m, EA3m,
Further details of these learning outcomes can be found at https://www.engc.org.uk/.

Mode of Assessment				
Type	Method	Description	Length	Weighting
Summative	Examination - Open Book	Four compulsory exam questions	1 hour 30 mins	60%
Summative	Laboratory Report	Lab report on individually set Computational Fluid Dynamics problem detailing solution compared to experimental data	N/A	40%

Reading List
To access the reading list for this module, please visit https://bradford.rl.talis.com/index.html

Please note:
This module descriptor has been published in advance of the academic year to which it applies. Every effort has been made to ensure that the information is accurate at the time of publication, but minor changes may occur given the interval between publishing and commencement of teaching. Upon commencement of the module, students will receive a handbook with further detail about the module and any changes will be discussed and/or communicated at this point.

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