Liverpool John Moores University

Title:	AERODYNAMICS
Status:	Definitive
Code:	**5510NCCG** (129443)
Version Start Date:	01-08-2021
Owning School/Faculty:	Engineering
Teaching School/Faculty:	Nelson Campus

Team	Leader
Christian Matthews	Y

Academic Level:	FHEQ5	**Credit Value:**	20	**Total Delivered Hours:**	60
Total Learning Hours:	200	**Private Study:**	140		

Delivery Options
Course typically offered: S1, S2, Sum, NS2 (S2 for Jan)

Component	Contact Hours
Lecture	48
Practical	12

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Report	Assignment	Assignment	100	

Competency	NCC Group Pass/Fail

Aims

This module aims to develop and extend the treatment of fluid mechanics to two-dimensional low speed flow and one-dimensional compressible flow; introduce the concepts of boundary layer theory; sources of drag (particularly aircraft drag); develop thin aerofoil theory and apply to the aerodynamic analysis of aerofoil sections in low speed flow; develop lifting line theory and apply to the aerodynamic analysis of unswept wings in low speed flow; describe the apparatus used and

techniques employed in wind tunnel testing, analyse the inviscid aerodynamic performance of an aerofoil section over a range of Mach numbers, from low subsonic to hypersonic conditions.

Learning Outcomes

After completing the module the student should be able to:

1	Analyse the properties of air and the atmosphere.
2	Calculate the effect of forces on the aerodynamic characteristics of aircrafts/vehicles.
3	Carry out investigations of the forces on various profiles under subsonic incompressible flow conditions
4	Apply the aerodynamic characteristics of wings with various profiles under various flow regimes (subsonic incompressible, subsonic compressible, transonic, supersonic).

Learning Outcomes of Assessments

The assessment item list is assessed via the learning outcomes listed:

Assignment	1	2	4
NCC Group Pass/Fail			3

Outline Syllabus

Hydrodynamics: governing equations; definition of vorticity and circulation; velocity potential and stream function.
Boundary Layer Theory: Basic concepts, thin layer assumptions, flat plate flows, skin friction; laminar and turbulent conditions, general introduction to pressure gradient effects.
Drag Sources: Types and origins of drag, drag reduction.
Aerofoil And Wing Theory For Low-Speed Flow: Aerofoil characteristics, lift, drag and pitching moment; NACA and other commonly used wing sections; Aerodynamic centre, centre of pressure, stall, high lift devices; Wings, aspect ratio, trailing and bound vortices, induced drag.
Reynolds number effects;
Wind Tunnel Testing: Subsonic wind tunnel design and operation, shock tubes; pressure, force and velocity measurement, flow visualisation.

Learning Activities

Lectures

These will not normally be traditional didactic lectures in which the student plays little active part, but will be delivered in small groups of up to 20 students in which their interaction with their tutor is a key ingredient of their learning experience.

The material of this module requires the development of significant practical skill. This will be taught within the lecture time, making these sessions a blend of lecture and workshop time. The sessions will be timetabled in spaces with physical resources appropriate to the delivered content.

Students will receive approximately 30 hours of taught material, supported by in-class exercises and discussions designed to help student assimilate learning and to provide early informal feedback on their progress.

Practical Work

This module contains directed practical work that students will undertake under the supervision of teaching staff and/or technicians. Some elements of this practical work will form part of the assessment for this module.

Independent Study

Students are expected to undertake personal reading and research into topic areas that have been stimulated from the lectures and seminars. This reading will enhance their academic work and enable valid contribution to lectures and seminars.

VLE support

This will provide links to academic web-sites and on-line journals, facilitate group discussion outside of the classroom, access to outline lecture notes, and provide students with assessment details.

Notes

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