AVIA H4604: Aircraft Stability and Control

Module Title:	Aircraft Stability and Control
Language of Instruction:	English

Credits:	5

NFQ Level:	8

Module Delivered In	1 programme(s)

Teaching & Learning Strategies:	The module will be delivered with a blend of lectures, tutorials and problem-based learning with laboratory sessions, and individual self-directed research. This will include case study exercises and demonstration videos.

Module Aim:	The aim of this module is to introduce learners to the fundamental theories of aircraft stability and control, and how to apply techniques to predict and analyse an aircraft's stability, control and handling characteristics.

Learning Outcomes	
On successful completion of this module the learner should be able to:	
LO1	Recognise the aircraft design characteristics that influence its stability and control properties.
LO2	Formulate the equations of motion for an aircraft in 2D flight, with focus on the stability and control derivatives.
LO3	Numerically predict and analyse the static and dynamic stability of an aircraft.
LO4	Analyse the operation and performance of a feedback control system using computer simulation techniques.

Pre-requisite learning
Module Recommendations *This is prior learning (or a practical skill) that is recommended before enrolment in this module.*
No recommendations listed
Incompatible Modules *These are modules which have learning outcomes that are too similar to the learning outcomes of this module.*
No incompatible modules listed
Co-requisite Modules
No Co-requisite modules listed
Requirements *This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed.*
No requirements listed

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Module Content & Assessment

Indicative Content
Flight Mechanics review • ISA • equations of motion • drag performance.
Equations of Motion • axis systems • equations of motion • linearisation • decoupling.
Stability and Control • fundamentals of stability and control • aircraft static and dynamic stability • contribution of aircraft components to stability and control • trim • aircraft static and dynamic stability • longitudinal, lateral and directional stability • stick fixed and stick free • neutral point • stability augmentation • aircraft modes of motion.
Stability and Control Derivatives • longitudinal derivatives • lateral derivatives • nondimensionalisation.
Control Systems • fundamentals as applied to aircraft • open and closed loop systems • reasons for using feedback • applications of feedback control to aircraft systems • state space representation.
Mathematical Modelling • use of differential equations • use of Laplace Transforms • aircraft system transfer functions • poles and zeros • block diagrams • SISO and MIMO systems.
Time and Frequency Response • transient and steady state responses • first and higher order responses • time delay • time response specifications • frequency response specifications • system gain in dB • bandwidth • bode plots • root locus method.
Sensitivity • open and closed loop systems • parameter variations • disturbance rejection • sensitivity functions.
Flying and Handling Qualities • assessment of flying and handling qualities • aircraft natural modes • stability augmentation systems.
Flight Testing • flight testing in a simulator • flight testing in a real live aircraft • flight test data capture and analysis.

Assessment Breakdown	%
Continuous Assessment	10.00%
Practical	30.00%
End of Module Formal Examination	60.00%

Continuous Assessment

Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Examination	Students will be expected to sit one or more individual written assessments throughout the academic year, typically at the conclusion of one or more learning outcomes.	1,2,3	10.00	Week 7

No Project

Practical

Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Practical/Skills Evaluation	Students will carry out a number of laboratory sessions throughout the academic year to enhance their understanding of the module, and will produce written reports describing each one. Laboratory practical work will include investigation of the following topics: static and dynamic stability analysis; computer simulation tools and mathematical modelling; real time flight analysis. A number of these laboratory sessions may take place in a simulated and/or a live aircraft flight environment.	1,2,3,4	30.00	Every Second Week

End of Module Formal Examination

Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Formal Exam	Students will sit a formal written examination at the end of the semester.	1,2,3	60.00	End-of-Semester

SETU Carlow Campus reserves the right to alter the nature and timings of assessment

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Module Workload

Workload: Full Time		
Workload Type	*Frequency*	*Average Weekly Learner Workload*
Lecture	12 Weeks per Stage	2.00
Laboratory	12 Weeks per Stage	2.00
Independent Learning Time	15 Weeks per Stage	5.13
	Total Hours	125.00

Module Delivered In

Programme Code	Programme	Semester	Delivery
CW_EEAER_B	Bachelor of Engineering (Honours) in Aerospace Engineering	8	Mandatory