School of Engineering

AERO3000: Flight Dynamics

Callaghan
Semester 1 - 2024

COURSE OUTLINE

OVERVIEW

Course Description
Students learn how to represent and evaluate aircraft stability, controllability and handling qualities. Commencing with the characterisation of aerodynamic properties, the course develops the mathematical representations and tools used to model the dynamics and stability of an aircraft, and its response to control. Students will obtain practical numerical skills in mathematical representation through flight simulation.

Academic Progress Requirements
Nil

Assumed Knowledge
AERO2000 Aircraft Performance and OperationsMATH2310 Calculus of Science and Engineering

Contact Hours

Callaghan

Lecture
Face to Face On Campus
3 hour(s) per week(s) for 13 week(s) starting Week 1

Tutorial
Face to Face On Campus
2 hour(s) per week(s) for 13 week(s) starting Week 1

Unit Weighting Workload
10
Students are required to spend on average 120-140 hours of effort (contact and non-contact) including assessments per 10 unit course.

CONTACTS

Course Coordinator

Callaghan
Dr Boyang Li
Boyang.Li@newcastle.edu.au
(02) 4055 0828
Consultation:

Teaching Staff

Other teaching staff will be advised on the course Canvas site.

School Office

School of Engineering
EAG03
EA Building
Callaghan
SENG-Admin@newcastle.edu.au
9.00am-1.00pm and 2.00pm-5.00pm (Monday to Friday)

SYLLABUS

Course Content

1. Representations of aircraft state.
2. Characterisation of aerodynamic properties.
3. Reference frames, axis systems and the representation of aircraft motion in six-degrees-of-freedom.
4. Introduction to stability concepts.
5. General equations of aircraft motion.
6. Aircraft static stability, equilibrium and trim.
7. Longitudinal and Lateral-Directional Motions.
8. Dynamic aircraft stability, controllability and handling qualities.
9. Time-domain solution of equations of motion.
10. Computational flight simulation.
11. Conventional flight controls and actuation systems.
12. Regulatory requirements relating to aircraft handling qualities.

Course Learning Outcomes

On successful completion of this course, students will be able to:

1. Mathematically represent the motion of an aircraft.

2. Estimate aerodynamic and control derivatives and their effects on equilibrium.

3. Analyse aircraft equilibrium and trim conditions.

4. Evaluate flight stability and interpret its impact on aircraft operations and pilot workload.

5. Appraise the handling qualities of an aircraft.

6. Model aircraft flight behaviours using computational techniques.

7. Analyse flight control mechanisms and critique their effectiveness.

8. Participate as an effective group member in a group project.

Course Materials

ASSESSMENTS

This course has 5 assessments. Each assessment is described in more detail in the sections below.

	Assessment Name	Due Date	Involvement	Weighting	Learning Outcomes
1	Modelling Aircraft Motion		Individual	15%	1, 2, 3
2	Aircraft Aerodynamics Modelling and Static Stability		Individual	15%	1, 2, 3, 4
3	In-class quiz		Individual	10%	1, 2, 4, 5
4	Flight Simulation and Dynamics Assessment		Group	20%	1, 3, 4, 6, 7, 8
5	Formal Examination		Individual	40%	1, 2, 3, 4, 5, 7

Late Submissions The mark for an assessment item submitted after the designated time on the due date, without an approved extension of time, will be reduced by 10% of the possible maximum mark for that assessment item for each day or part day that the assessment item is late. Note: this applies equally to week and weekend days.

Assessment 1 - Modelling Aircraft Motion

Assessment Type Written Assignment
Description
Weighting 15%
Due Date
Submission Method
Assessment Criteria
Return Method
Feedback Provided
Opportunity to Reattempt Students WILL NOT be given the opportunity to reattempt this assessment.

Assessment 2 - Aircraft Aerodynamics Modelling and Static Stability

Assessment Type Written Assignment
Description
Weighting 15%
Due Date
Submission Method
Assessment Criteria
Return Method
Feedback Provided
Opportunity to Reattempt Students WILL NOT be given the opportunity to reattempt this assessment.

Assessment 3 - In-class quiz

Assessment Type Quiz
Description
Weighting 10%
Due Date
Submission Method
Assessment Criteria
Return Method
Feedback Provided
Opportunity to Reattempt Students WILL NOT be given the opportunity to reattempt this assessment.

Assessment 4 - Flight Simulation and Dynamics Assessment

Assessment Type	Written Assignment
Description	
Weighting	20%
Due Date	
Submission Method	
Assessment Criteria	
Return Method	
Feedback Provided	
Opportunity to Reattempt	Students WILL NOT be given the opportunity to reattempt this assessment.

Assessment 5 - Formal Examination

Assessment Type	Online Open Book Formal Examination
Description	
Weighting	40%
Due Date	
Submission Method	
Assessment Criteria	
Return Method	
Feedback Provided	
Opportunity to Reattempt	Students WILL be given the opportunity to reattempt this assessment.

ADDITIONAL INFORMATION

Grading Scheme

This course is graded as follows:

Range of Marks	Grade	Description
85-100	High Distinction (HD)	Outstanding standard indicating comprehensive knowledge and understanding of the relevant materials; demonstration of an outstanding level of academic achievement; mastery of skills*; and achievement of all assessment objectives.
75-84	Distinction (D)	Excellent standard indicating a very high level of knowledge and understanding of the relevant materials; demonstration of a very high level of academic ability; sound development of skills*; and achievement of all assessment objectives.
65-74	Credit (C)	Good standard indicating a high level of knowledge and understanding of the relevant materials; demonstration of a high level of academic achievement; reasonable development of skills*; and achievement of all learning outcomes.
50-64	Pass (P)	Satisfactory standard indicating an adequate knowledge and understanding of the relevant materials; demonstration of an adequate level of academic achievement; satisfactory development of skills*; and achievement of all learning outcomes.
0-49	Fail (FF)	Failure to satisfactorily achieve learning outcomes. If all compulsory course components are not completed the mark will be zero. A fail grade may also be awarded following disciplinary action.

*Skills are those identified for the purposes of assessment task(s).

Communication Methods Communication methods used in this course include:

Course Evaluation Each year feedback is sought from students and other stakeholders about the courses offered in the University for the purposes of identifying areas of excellence and potential

improvement.

Oral Interviews (Vivas)

As part of the evaluation process of any assessment item in this course an oral examination (viva) may be conducted. The purpose of the oral examination is to verify the authorship of the material submitted in response to the assessment task. The oral examination will be conducted in accordance with the principles set out in the Oral Examination (viva) Procedure. In cases where the oral examination reveals the assessment item may not be the student's own work the case will be dealt with under the Student Conduct Rule.

Academic Misconduct

All students are required to meet the academic integrity standards of the University. These standards reinforce the importance of integrity and honesty in an academic environment. Academic Integrity policies apply to all students of the University in all modes of study and in all locations. For the Student Academic Integrity Policy, refer to https://policies.newcastle.edu.au/document/view-current.php?id=35.

Adverse Circumstances

The University acknowledges the right of students to seek consideration for the impact of allowable adverse circumstances that may affect their performance in assessment item(s). Applications for special consideration due to adverse circumstances will be made using the online Adverse Circumstances system where:

1. the assessment item is a major assessment item; or
2. the assessment item is a minor assessment item and the Course Co-ordinator has specified in the Course Outline that students may apply the online Adverse Circumstances system;
3. you are requesting a change of placement; or
4. the course has a compulsory attendance requirement.

Before applying you must refer to the Adverse Circumstance Affecting Assessment Items Procedure available at:
https://policies.newcastle.edu.au/document/view-current.php?id=236

Important Policy Information

The Help button in the Canvas Navigation menu contains helpful information for using the Learning Management System. Students should familiarise themselves with the policies and procedures at https://www.newcastle.edu.au/current-students/respect-at-uni/policies-and-procedures that support a safe and respectful environment at the University.

Graduate Profile Statements

This course builds students' capacity in the following University of Newcastle Bachelor of Engineering Graduate Profile Statements (based on 2011 Engineers Australia revised Stage 1 Competency Standards for Professional Engineers):

UON Att.	University of Newcastle Bachelor of Engineering Graduate Profile Statements/ Engineers Australia Stage 1 competency statements	Taught	Practised	Assessed	Skill Level (1-4)
	Professional Attributes				
11	3.1. Ethical conduct and professional accountability		X		3
12	3.2. Effective oral and written communication in professional and lay domains.		X	X	3
13	3.3. Creative, innovative and pro-active demeanour.				
14	3.4. Professional use and management of information.		X		2
15	3.5. Orderly management of self, and professional conduct.		X		2
16	3.6. Effective team membership and team leadership.	X	X	X	3
	Engineering Ability				
7	2.1. Application of established engineering methods to complex engineering problem solving.	X	X	X	3
8	2.2. Fluent application of engineering techniques, tools and resources.	X	X	X	3
9	2.3. Application of systematic engineering synthesis and design processes.				
10	2.4. Application of systematic approaches to the conduct and management of engineering projects.				
	Knowledge Base				
1	1.1. Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline.		X		3
2	1.2. Conceptual understanding of the, mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline.		X		3
3	1.3. In-depth understanding of specialist bodies of knowledge within the engineering discipline.	X	X	X	3
4	1.4. Discernment of knowledge development and research directions within the engineering discipline.				
5	1.5. Knowledge of contextual factors impacting the engineering discipline.	X	X	X	3
6	1.6. Understanding of the scope, principles, norms, accountabilities and bounds of contemporary engineering practice in the specific discipline.	X	X	X	3

This course outline was approved 6/02/2024 by the Head of School. No alteration of this course outline is permitted without Head of School approval. If a change is approved, students will be notified and an amended course outline will be provided in the same manner as the original.