

MNE3202: AIRCRAFT DYNAMICS

Effective Term

Semester A 2025/26

Part I Course Overview

Course Title

Aircraft Dynamics

Subject Code

MNE - Mechanical Engineering

Course Number

3202

Academic Unit

Mechanical Engineering (MNE)

College/School

College of Engineering (EG)

Course Duration

One Semester

Credit Units

3

Level

B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction

English

Medium of Assessment

English

Prerequisites

MNE2109 Engineering Mechanics and MNE2204 Aircraft System Design

Precursors

Nil

Equivalent Courses

Nil

Exclusive Courses

Nil

Additional Information

#Prerequisites which are not part of the Major Requirement are waived for students admitted with Advanced Standing.

Part II Course Details

Abstract

The purpose of this course is to show students how aircraft responds to various control inputs and external forces, focusing on the mathematical models and the physical principles underlying the motion of airplanes. It involves understanding the three rotational degrees of freedom (roll, pitch, and yaw) and the three translational degrees of freedom (forward/backward, up/down, left/right) that an aircraft can experience.

Course Intended Learning Outcomes (CILOs)

CILOs		Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	To be able to describe the fundamental principles of aircraft dynamics.			x	
2	To be able to model the motion of aircraft in response to various forces and moments.			x	
3	To be able to analyze the stability and control characteristics of aircraft. Apply theoretical concepts to practical dynamics problems.			x	
4	Present results, analyses and conclusions from experiments or simulations in a written report such that a technically qualified person can obtain a clear understanding of the findings.			x	

A1: Attitude

Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability

Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments

Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Learning and Teaching Activities (LTAs)

LTAs		Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	This includes a combination of lectures and tutorial classes on a range of aircraft dynamical systems accompanied by in-class problem solving sessions.	1, 2, 3	3 hrs/week

2	Laboratory	Students will carry out practical laboratory exercises covering a range of experimental techniques and applications. These will be reported in the form of a short and concise technical report.	3, 4	3 hrs/week for 1 week
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Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("- " for nil entry)	Allow Use of GenAI?
1	Assignments	1, 2, 3	30	3-5 assignments to be submitted.	Yes
2	Laboratory Reports	3, 4	10	1 report to be submitted	Yes

Continuous Assessment (%)

40

Examination (%)

60

Examination Duration (Hours)

2

Minimum Continuous Assessment Passing Requirement (%)

30

Minimum Examination Passing Requirement (%)

30

Additional Information for ATs

For a student to pass the course, at least 30% of the maximum mark for both coursework and examination should be obtained.

Assessment Rubrics (AR)**Assessment Task**

Assignments

Criterion

Describe the fundamental concepts of dynamical systems and apply them to solve problems with given principles.

Excellent (A+, A, A-)

Strong evidence of original thinking; good organization, capacity to analyze and synthesize; superior grasp of subject matter; evidence of extensive knowledge base.

Good (B+, B, B-)

Significant evidence of grasp of subject, some evidence of critical capacity and analytic ability; reasonable understanding of issues; evidence of familiarity with course matter.

Fair (C+, C, C-)

Student is profiting from the university experience; understanding of subjects; ability to develop solutions to simple problems in the course.

Marginal (D)

Basic familiarity with the subject matter to enable the student to progress without repeating the course.

Failure (F)

Little evidence of familiarity with the subject matter; weakness in critical and analytic skills; very limited demonstration of correct use knowledge.

Assessment Task

Laboratory Reports

Criterion

Ability to explain the methodology and procedures used in aircraft experiments and analyse the experimental data, discuss the experimental findings with concise conclusions.

Excellent (A+, A, A-)

Strong evidence of critical thinking; good organization, capacity to analyze and synthesize; superior grasp of subject matter; evidence of extensive knowledge of the experimental matters concerned.

Good (B+, B, B-)

Evidence of grasp of subject, some evidence of critical capacity and analytic ability; reasonable understanding of issues; evidence of familiarity with experiment.

Fair (C+, C, C-)

Student who is profiting from the laboratory class; understanding of the subject; ability to develop solutions to concerning the experiment.

Marginal (D)

Sufficient familiarity with the laboratory content to enable the student to move on to other laboratory materials.

Failure (F)

Little evidence of familiarity with the laboratory class materials; weakness in critical and analytic skills; limited, or irrelevant use of data.

Assessment Task

Examination

Criterion

Demonstrate an understanding of the fundamental concepts of aircraft dynamics, to be able to analyze the stability and control characteristics of aircraft.

Excellent (A+, A, A-)

Strong evidence of original thinking; good organization, capacity to analyze and synthesize; superior grasp of subject matter; evidence of extensive knowledge base.

Good (B+, B, B-)

Significant evidence of grasp of subject, some evidence of critical capacity and analytic ability; reasonable understanding of issues; evidence of familiarity with course matter

Fair (C+, C, C-)

Student is profiting from the university experience; understanding of heat transfer; ability to develop solutions to simple problems in the course.

Marginal (D)

Basic familiarity with the subject matter to enable the student to progress without repeating the course.

Failure (F)

Little evidence of familiarity with the subject matter; weakness in critical and analytic skills: very limited demonstration of correct use knowledge in heat transfer.

Additional Information for AR

Note: For a student to pass the course, at least 30% of the maximum mark for both coursework and examination should be obtained.

Part III Other Information

Keyword Syllabus

Low-speed aerodynamics, 2D and 3D airfoils, stall, lift-elevating devices, stability, control, longitudinal dynamics, lateral dynamics, feedback control, high-speed flying, flying qualities, manoeuvres for a aircraft for Landing, Taxiing and Take-off.

In addition to the examination and in-class test, students are required to learn through collaborative lab sessions in order to improve their understanding on strategic thinking, problem solving, team working processes, the relationships and interactions between the fields of knowledge that they have learnt in this and other courses.

Reading List

Compulsory Readings

Title	
1	R. F. Stengel, Flight Dynamics, Second Edition, Princeton University Press, 2022.

Additional Readings

Title	
1	M. J. Abzug and E. E. Larrabee, Airplane Stability and Control: A History of the Technologies that Made Aviation Possible, Cambridge University Press, 2002.