

MNE3202: AIRCRAFT DYNAMICS

Effective Term

Semester A 2022/23

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

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 aerospace structures behave when they experience free and forced vibration and how to describe the general motion of a rigid body. Vibration of SDOF and MDOF systems, an introduction to continuous systems, rigid body dynamics in 2D and basic ground manoeuvres of a rigid aircraft with appropriate case studies will be described.

Course Intended Learning Outcomes (CILOs)

| CILOs | | Weighting (if DEC-A1 DEC-A2 DEC-A3 app.) | | |
|-------|---|--|--|---|
| 1 | To be able to describe dynamical systems in terms of lumped parameters, obtain and solve the resulting equations of motion. To gain an understanding of the dynamics of continuous systems. | | | x |
| 2 | To be able to describe rigid body dynamics in two dimensions as applied to rigid aircraft structures. | | | x |
| 3 | Understand the dynamics of the ground manoeuvres of a rigid aircraft. | | | 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.

Teaching and Learning Activities (TLAs)

| TLAs | Brief Description | CILO No. | Hours/week (if applicable) |
|------|-------------------|---|----------------------------|
| 1 | Lecture | This includes a combination of lectures and tutorial classes on a range of mechanical and aerospace 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 2 weeks |
|---|------------|--|------|------------------------|

Assessment Tasks / Activities (ATs)

| | ATs | CILO No. | Weighting (%) | Remarks (e.g. Parameter for GenAI use) |
|---|----------------------|----------|---------------|--|
| 1 | Test and Assignments | 1, 2, 3 | 20 | 2-3 assignments to be submitted. |
| 2 | Laboratory Reports | 3, 4 | 20 | 2 reports to be submitted |

Continuous Assessment (%)

40

Examination (%)

60

Examination Duration (Hours)

3

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**

Test and Assignments

Criterion

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

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Assessment Task

Laboratory Reports

Criterion

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

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Assessment Task

Examination

Criterion

Demonstrate an understanding of the fundamental concepts of modelling lumped parameter and continuous systems to extract the dynamic characteristics, to be able to understand 2D rigid body dynamics with reference to a rigid aircraft.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

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

Vibration of single degree of freedom systems, Multi degree of freedom systems, An introduction to continuous systems, 2D rigid body dynamics with fixed (inertial) and moving axes, Ground manoeuvres for a rigid 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 | An Introduction to Aircraft Aeroelasticity and Loads, 2nd edition, J Wright and J Cooper, Wiley. |

Additional Readings

| Title | |
|-------|---|
| 1 | Fundamentals of vibration, Meirovitch, McGraw-Hill. |