MNE3206: FLIGHT CONTROL SYSTEMS ENGINEERING

Effective Term
Semester A 2022/23

Part I Course Overview

Course Title
Flight Control Systems Engineering

Subject Code
MNE - Mechanical Engineering
Course Number
3206

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
MNE3205 Flight 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

This course introduces the student to the fundamentals of control system design and analysis. Flight control systems impact upon manoeuvres, gusts, flutter and static elasticity calculations and students will obtain a working knowledge of classical and modern control theory including case studies of aerospace flight control systems to understand and demonstrate the role of control engineering in flight dynamics.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Understand the underlying principles of automatic control systems and apply these to the basic design of control systems in aerospace applications.			x	
2	To be able to explain and analyse open loop and closed loop controllers, evaluate the stability of controllers, to apply appropriate methods to evaluate control systems in real situations.			x	
3	Formulate solutions using relevant principles for the design of control systems in aerospace applications and handling qualities.			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 classical and modern control theory accompanied by in-class problem solving sessions and case studies.	1, 2, 3	3 hrs/week

2	Laboratory	Students will carry out practical laboratory exercises to design simple open and closed loop control systems. 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

To be able to design and model SISO control systems and assess the performance in terms of stability and response characteristics.

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 data, discuss the 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 principles of control systems and to solve problems relating to the design and use of control engineering for aerospace vehicles.

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

An introduction to control systems and its use in flight control, Open and Closed loop systems, System modelling, Stability of feedback systems, Root-Locus design techniques, Frequency Response techniques, Design of State Space feedback systems, Case studies of aerospace control systems.

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	Flight Control Systems: Practical issues in design and implementation, R Pratt, IET, 2000.

Additional Readings

	Title
1	Nil