

MNE4212: MORE ELECTRIC AIRCRAFT

Effective Term

Semester A 2023/24

Part I Course Overview

Course Title

More Electric Aircraft

Subject Code

MNE - Mechanical Engineering

Course Number

4212

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

Nil

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 students to the more-electric aircraft and the important technologies for enabling the advancement of the aircraft. Technologies in this field are developing rapidly due to improved battery capabilities, power storage, and the importance of green requirements from Government agencies. Students will learn about different types of electrical machines and drives for aircraft applications, the power electronics involved, power distribution for both AC and DC systems, Control requirements for more-electric aircraft, Power Storage, Hybrid-electric aircraft, Modelling and simulation methodologies for designing more-electric aircraft.

Course Intended Learning Outcomes (CILOs)

CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Understand and explain the underlying principles of more-electric and hybrid-electric aircraft, the design requirements, the power electronics and distribution, the propulsion and the enabling technologies for the more-electric aircraft.		x	
2	To be able to describe the power electrical converters for more-electric aircraft applications and the electrification of aircraft systems including the conversion from pneumatics and hydraulics to electrical control.		x	
3	To use modelling and simulation techniques for the design of more-electric and hybrid-electric aircraft, understand and explain the safety requirements for the operation of more-electric 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 the design and development of Electric Aircraft including hybrid technologies, power and propulsion systems, modelling and simulation methodologies, maintainability requirements for more and hybrid electric aircraft.	1, 2, 3	3 hrs/week
2	Laboratory	Students will carry out practical/simulation exercises to study the important aspects of the more electric aircraft. 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 carry out studies of more electric aircraft technologies and developments using modelling and simulation studies, operating principles, performance and efficiency.

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 and interpret the results from exercises involving more electric and hybrid electric aircraft technologies.

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 fundamentals of more electric and hybrid electric aircraft, design principles, power generation and distribution, modelling methodologies, electro-mechanical aspects of the more electric aircraft, to solve problems relating to the maintainability and performance and efficiency of more electric and hybrid systems.

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**

Overview of aircraft electrification technologies: transformation from current engineering technologies to electrical systems, electrical power generation (AC and DC) and distribution systems, propulsion technologies for more and hybrid electric aircraft, architecture and control engineering requirements, modelling and simulation methodologies for design studies, maintainability requirements.

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	Fundamentals of Electric Aircraft, P Thalin, SAE International (this text seems to be a comprehensive starting point for this subject).

Additional Readings

Title	
1	Nil