MNE2204: AIRCRAFT SYSTEM DESIGN

Effective Term
Semester B 2024/25

Part I Course Overview

Course Title
Aircraft System Design

Subject Code
MNE - Mechanical Engineering
Course Number
2204

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
MNE2113 Aircraft System Design

Exclusive Courses
Nil

Part II Course Details

Abstract
Aircraft system design is a process to produce an aircraft that is strong, lightweight, economical and can carry an adequate payload while being sufficiently reliable to safely fly for the design life. This course is to introduce students to the typical

aircraft industry practice and the overall aircraft design process. The students will first be introduced to the overview of past and current aircraft designs and configurations, and regulations that need to be considered before the design process takes place. Then the students will be introduced to the technical aspects of designing aircraft starting with specifying the mission requirements, based on the market research analysis. The process is then followed by preliminary sizing and weight estimation. Upon designing the overall configuration and fuselage layout, the students can then perform more detailed analyses such as: wing design, controls, stability, landing gear, propulsion, and structural consideration.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	To equip students with the required knowledge to conduct conceptual design of different types of aircraft, distinguish and understand the design phases of an aircraft.		x		
2	To be able to calculate total weight and weight fractures of an aircraft, understand sizing of an aircraft, layout design of different aircraft, and be able to calculate performance characteristics of an aircraft.			x	x
3	To understand the technology edges and the areas of research in Aerospace and Aeronautics, appreciate environmental issues associated with the area of Aeronautics, such as energy conservation, pollution etc.		x	x	
4	To understand the method of preparation design tasks and technical reports, develop problem solving skills i.e. identify main issues in aeronautical problems, simplify the problem and solve it using standard tools.		x	x	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	Classroom lectures on the topics of the keyword syllabus.	1, 2, 3, 4	3 hrs/week

2	Project	Projects in form of aircraft design, or review of state-of-art aircraft industries, and presentations.	1, 2, 3, 4	3 hrs for 2 weeks

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Assignments	1, 2, 3, 4	30	Classroom quizzes, homework problems
2	Project	2, 3, 4	20	Students will perform project and write project reports

Continuous Assessment (%)

50

Examination (%)

50

Examination Duration (Hours)

2

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

Ability to analyse aircraft design problems, perform basic calculations of performance characteristics of an aircraft, and understand fundamental concepts 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 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

Project

Criterion

Ability to understand the method of design tasks and technical reports, develop problem solving skills in aeronautical problems, simplify the problem and solve it using standard tools.

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 project 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 project.

Fair (C+, C, C-)

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

Marginal (D)

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

Failure (F)

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

Assessment Task

Examination

Criterion

Ability to calculate total weight and weight fractures of an aircraft, understand sizing of an aircraft, layout design of different aircraft, and performance of an 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 aircraft design; 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.

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 designs, configurations, and regulations
- Preliminary weight estimation
- Preliminary sizing, drag polar, wing loading (W/S) and thrust-to-weight ratio (T/W)
- Configuration design, fuselage layout
- Wing design, high-lift devices, controls, empennage
- Weights, center of gravity (CG), stability
- Landing gear design and disposition
- Structural consideration, V-n diagram, load paths
- Basic cost analysis and estimation

Reading List

Compulsory Readings

	Title
1	Daniel Raymer, Aircraft Design: a conceptual approach, 6th edition, 2018.

Additional Readings

	Title
1	I. Moir amd A.G. Seabridge, Design and Development of Aircraft Systems – An Introduction, First Edition, AIAA Education Series, 2004.
2	Richard De Neufville. Airport Systems: Planning, Design, and Management, McGraw-Hill, 2003.
3	Jon D. Fricker and Robert K. Whitford, Fundamentals of Transportation Engineering: A Multimodel Systems Approach, Prentice-Hall, 2004.