MNE4214: UNMANNED AIR VEHICLES

Effective Term
Semester A 2022/23

Part I Course Overview

Course Title
Unmanned Air Vehicles

Subject Code
MNE - Mechanical Engineering
Course Number
4214

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
MNE3203 Aerospace Propulsion Systems

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 is an introduction to the rapidly developing area of unmanned aerial vehicles and systems. The student will be exposed to the current technologies involved in the design of UAV’ s, the basic system design requirements, the governing equations for the aerodynamic performance, how to ensure stable and controlled flight programmes, power and propulsion technologies including launch and recovery, the basic communications systems, navigation control, the materials, structural design, reliability and maintenance requirements, dynamic loads for UAV’ s, the future challenges for unmanned air vehicles.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Have a sound knowledge and understanding of the technologies associated with unmanned air vehicles, the key system design principles including electrical power, control, propulsion, communication and navigation.			x	
2	To be able to use the appropriate equations for aerodynamic performance of unmanned air vehicles including stability control, navigation and performance requirements.			x	
3	To use modelling and simulation techniques for the design and construction of unmanned air vehicles taking account of dynamic loads, structural and material properties.			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 key systems technologies for unmanned air vehicles, the aerodynamics, structural design, power requirements, communications, navigation, propulsion and structural design, reliability and maintenance and mission methodologies, modelling and simulation methodologies for unmanned air vehicle design.	1, 2, 3	3 hrs/week
2	Laboratory	Students will carry out practical/simulation exercises to study the important design and performance aspects of unmanned air vehicles. 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 into unmanned air vehicle design and performance characteristics using practical and modelling/ simulation studies.

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, interpret and analyse the results from exercises involving studies of unmanned air vehicle design and performance 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
Examination

Criterion
To be able to solve problems relating to the system design and performance of unmanned air vehicles, to analyse and interpret the performance requirements including aerodynamic, propulsion, structural and power aspects.

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 and overview of current UAV (unmanned aerial vehicles) technology, unmanned air vehicle system design including reliability and maintenance, basic aerodynamics and configurations of UAV' s, stability and control methodologies, power sources and propulsion technologies, communication systems, navigation control, materials and structural design, dynamic loads, future UAV demands and challenges.

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	Theory, Design and Applications of Unmanned Aerial Vehicles, A Jha, CRC Press, 2020.

Additional Readings

	Title
1	Introduction to UAV Systems, Fahlstrom and Gleason, Wiley, 2012.