Subject Description Form

Subject Code	AAE5203
Subject Title	Aircraft Design and Certification
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Exclusion: ME578 Aircraft Design
Objectives	1. To provide students with the key knowledge relevant to the process and principle of aircraft design, and the capacity to formulate the design requirements for an aircraft using modern engineering tools. 2. To provide students with the multi-disciplinary design optimization (MDO) knowledge to conduct aircraft system optimization from aerodynamics, propulsion, structure, stability, and performance perspectives. 3. To provide students with the knowledge about aircraft certification process and requirement.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. understand fundamental concepts and constraints during an aircraft design process; b. evaluate common aircraft configurations; c. design and layout aircraft major components; d. design and sizing aircraft that meets aerodynamic requirements; e. optimize the aircraft design process by multi-disciplinary design optimization principles; and f. understand airworthiness and aircraft certification process during an aircraft design.

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<tr><td>Subject Synopsis/ Indicative Syllabus</td><td>
Introduction to Aircraft Design: Design process and basic aircraft requirements; Evolution of aircraft design and its performance: a brief history; Overview of aircraft design iteration cycle

Modern Aircraft Configuration: Advantages and drawbacks of conventional and modern configurations; Considerations for special aircraft; Primary considerations for the fuselage, wing, and tail design

Aerodynamic Consideration of Aircraft Design: Fundamentals of aerodynamic; Friction and pressure drag; Airfoil; Finite wings; Drag and lift; Dependence of lift and drag on the angle of attack; End effects of wingtips; Induced drag

Sizing and Costing: Internal layout; Structures and weight; Geometry constraints; Sizing equation; Weight fraction method; Weight and balance; Cost analysis; Elements of life-cycle cost; Cost-estimating methods; Operations and maintenance costs; Cost measures of merit

Main Components Selection and Design: Selection and design of main components such as fuselage, wing, tail and landing gear; Calculation and design of control surfaces such as aileron, elevator and rudder

Multi-disciplinary Design Optimization (MDO): uses optimization methods to solve design problems incorporating a number of disciplines

Aircraft certification and Airworthiness: Airworthiness requirements; Load factor determination; Aircraft safety; Airframe loads; Designing against fatigue; Prediction of aircraft fatigue life
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<tr><td>Teaching/Learning Methodology</td><td>
Lectures are used to deliver the fundamental knowledge in relation to aircraft design. Tutorials and case study are used to illustrate the application of fundamental knowledge to practical situations.
<table>
<tr><td rowspan="2">Teaching/Learning Methodology</td><td colspan="6">Outcomes</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td></tr>
<tr><td>Lecture</td><td>√</td><td></td><td>√</td><td>√</td><td></td><td>√</td></tr>
<tr><td>Tutorial/Case Study</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
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Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
		a	b	c	d	e	f
1. Assignment/Test	20%	√	√		√	√	√
2. Design Project	30%	√	√	√	√	√	√
3. Examination	50%	√	√	√	√	√	√
Total	100%						

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:

$$0.5 \times \text{Continuous Assessment} + 0.5 \times \text{Final Examination}$$

Examination is adopted to assess students on the overall understanding and the ability of applying the concepts. It is supplemented by continuous assessment including assignment, closed-book test and design project. The continuous assessment is aimed at enhancing the students' comprehension and assimilation of various topics of the syllabus. Design project is used to assess the students' capacities of self-learning and problem-solving and effective communication skill in English to fulfil the requirements of being aircraft design engineers.

Student Study Effort Expected

Class contact:	
▪ Lecture	33 Hrs.
▪ Tutorial/case study	6 Hrs.
Other student study effort:	
▪ Course work and design project	42 Hrs.
▪ Self-study	25 Hrs.
Total student study effort	106 Hrs.

Reading List and References

1. Raymer D., Aircraft Design: A Conceptual Approach. American Institute of Aeronautics and Astronautics, Inc., 2018.
2. Torenbeek E., Advanced Aircraft Design: Conceptual Design, Technology and Optimization of Subsonic Civil Airplanes, John Wiley & Sons, 2013.
3. Raymer D., Enhancing Aircraft Conceptual Design Using Multidisciplinary Optimization, Swedish Royal Institute of Technology (KTH), 2002.