MECH3620 - Aircraft Design

Course Code: MECH 3620	**Course Title:** Aircraft Design
Required Course Or Elective Course: Required	**Terms Offered (Credits):** Spring, 3 credits
Faculty In Charge: Rhea Liem	**Pre/Co-Requisites:** Pre-requisites: MECH3640 & MECH3650 Co-requisites: MECH3660 & MECH3670
Course Structure: Lecture – 3 hours per week; Tutorial – 1 hour per week	
Textbook/Required Material:	

Course Description:

The main objective of this course is to introduce students to the overall aircraft design process, following the typical industry practice. This process typically starts 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. The students will also learn to perform basic cost analyses for aircraft.

Due to the complexity of the aircraft system, the aircraft design is typically performed iteratively. This is mainly due to the interdisciplinary coupling within the system, i.e., how changing one parameter will affect the others. The students thus need to be exposed to the different disciplines involved in designing aircraft (e.g., aerodynamic, structures, propulsion, control, stability, avionics, etc.) and understand the relationship between them. Students would know how to perform the basic analyses of the aircraft performance and interpret the results. Communication skill is another important aspect of the project, both in maintaining a solid teamwork between the team members and in presenting the work (oral and written).

In addition to the technical aspects of designing aircraft, the students will first be introduced to the overall design processes, overview of past and current aircraft designs and configurations, as well as regulations that need to be taken into account before the design process takes place.

Course Topics:

1. Overview of Aircraft Designs, Configurations, and Regulations
2. Overview of Aircraft Design Processes
3. Preliminary Weight Estimation
4. Basic Cost Analysis and Estimation
5. Preliminary Sizing, Drag Polar, Wing Loading (W/S) and Thrust-To-Weight Ratio (T/W)
6. Configuration Design, Fuselage Layout
7. Wing Design, High-Lift Devices, Controls, Empennage
8. Weights, Center of Gravity (CG), Stability
9. Landing Gear Design and Disposition
10. Propulsion
11. Structural Consideration, V-n Diagram, Load Paths
12. Sizing and Configuration Refinement
13. Overview of Aerospace Computation and Optimization for Aircraft Design, Tradeoff Studies, and Sensitivity Studies

Course Objectives:	1. This course trains engineers to meet those challenges, and prepares them for careers in civil and military aviation.

	2. It aims is to provide a comprehensive overview of aircraft performance, structures, aerodynamics and advanced systems. 3. A holistic teaching approach will be used to explore how the individual elements of an aircraft can be designed and integrated using up-to-date techniques. 4. Students will learn to understand how to select specific systems, such as the engines, and how this selection will affect the aircraft as a whole.
Course Outcomes:	A. Students will develop an understanding of aircraft design methodology through lectures, and then apply that understanding to a real-life case study involving a complete aircraft through team-based projects**.** B. Management, communication, team work and research skills; solve problems as part of a team and assume leadership duties. C. Understand and implement the design and development process for aerospace vehicles. D. Perform open-ended iterative tasks related to aircraft/engine design and airframe−engine integration. E. Integrate a variety of systems and sub-systems within aircraft to demonstrate design feasibility. F. Demonstrate design viability through testing and verification. G. Prioritize design requirements/trade-offs and organize project schedules/deadlines; use formal structured design methods to develop aircraft that meet or exceed customer expectations.
Assessment Tools:	Written Assignment 10% Project Report 50% Presentation 15% Individual term paper 25%