

THE DEPARTMENT OF AERONAUTICS AND ASTRONAUTICS

AA 410 AIRCRAFT DESIGN I

WINTER QUARTER

CREDITS AND

CONTACT HOURS: 4 Credits, Three 2 hour lectures and group work sessions and two 50 minute lectures per week.

COORDINATOR: Eli Livne, Professor of Aeronautics and Astronautics.

TEXTBOOK: Aircraft Design: A Conceptual Approach, Daniel Raymer, Fifth Edition, American Institute of Aeronautics and Astronautics, 2012.

SUPPLEMENTAL MATERIALS:

Fundamentals of Aircraft and Airship Design, AIAA Education Series, Leeland Nicolai and Grant Carichner, American Institute of Aeronautics and Astronautics, 2010.

Airplane Design, J. Roskam, Roskam Aviation and Engr Corp. Vols. 1-8, 1985-1990.

Synthesis of Subsonic Airplane Design, E. Torenbeek, Delft University Press, 1982.

CATALOG DATA:

AIRCRAFT DESIGN I, Required

Conceptual design of a modern airplane to satisfy a given set of requirements. Estimation of size, selection of configuration, weight and balance, and performance. Satisfaction of stability, control, and handling qualities requirements. Prerequisite: AA 302. Offered: W.

PREREQUISITES BY TOPIC:

- 1) Aerodynamics
- 2) Dynamics
- 3) Propulsion
- 4) Flight mechanics
- 5) Structures

OUTCOMES:

- 1) Students will be able to carry out conceptual design and sizing of airplane systems.
- 2) Students will understand the interaction between key relevant disciplines, and the trade-offs, in airplane systems design.
- 3) Students will understand the function of aircraft components and subsystems and how they might be designed.
- 4) Students will understand systems engineering issues as they relate to mission goals and requirements.
- 5) Students will experience self-organization, delegation, teamwork, communication to peers and visitors, fiscal and schedule maintenance.
- 6) Students will experience hands-on prototyping and testing of their chosen design and supporting coupons and models.

RELATIONSHIP TO STUDENT OUTCOMES:

- a) An ability to apply knowledge of mathematics, science, and engineering.

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- b) An ability to design and conduct experiments, as well as to analyze and interpret data.
- c) An ability to design a system, component, or process to meet desired needs.
- d) An ability to function on multi-disciplinary teams.
- e) An ability to identify, formulate, and solve engineering problems.
- f) An understanding of professional and ethical responsibility.
- g) An ability to communicate effectively.
- h) The broad education necessary to understand the impact of engineering solutions in a global and societal context.
- i) A recognition of the need for, and an ability to engage in life-long learning.
- j) A knowledge of contemporary issues.
- k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

TOPICS:

- 1) The design process: its creative/qualitative and analytical/quantitative aspects
- 2) Organization, milestones and schedule of the airplane design process
- 3)* Discussion of Ethics in design.
- 4) Design oriented applied aerodynamics
- 5) Design oriented applied mission analysis
- 6) Design oriented weight estimation and design oriented stability and control.
- 7) Wind design
- 8) Cabin and fuselage design
- 9) Tail design
- 10) Airframe/engine integration
- 11) Landing gear and systems design.
- 12) Design to meet regulations.
- 13) Cost and manufacturing.
- 14) Automated, computerized design and design optimization.
- 15) Case studies in airplane design: the analysis of design failures.