

**1. Department, Course Number, and Course Title:**

**MECHANICAL ENGINEERING**

**ME 403 AERODYNAMICS**

**2. Designation:** Required  Elective   
Lower Division  Upper Division

**3. Course Description:** Airfoil characteristics; transonic, supersonic, and viscous effects on lift and drag; power considerations, plane performances, introduction to airplane and missile stability and control.

**4. Prerequisites:** CE/ME 303 (Fluid Mechanics I), MATH 208 (Calculus III)

**5. Text and Materials:** Brandt, Introduction to Aeronautics–A Design Perspective, 2<sup>nd</sup> Edition, AIAA Education Series, 2004.

**6. Course Objectives:** The student will develop a fundamental understanding of aerodynamics, propulsion systems and their relationship to the design of aircraft and aircraft performance.

Course Outcomes

- the ability to calculate properties of air in standard and non-standard atmospheric conditions.
- an appreciation for the history of aviation and aerodynamics
- the ability to estimate aerodynamic forces on a flying vehicle.
- the ability to select an airfoil and design a wing.
- the ability to select an adequate propulsion system and predict its performance.
- an introductory understanding of flight mechanics and flight stability.
- the broad education necessary to understand the impact of engineering solutions in a global/societal context.
- an ability to communicate effectively.
- a desire to be a flexible and adaptable team player.

**7. Topics Covered:** (in Order of Presentation)

- History and Trends in Aircraft Design – Ch. 1
- Properties of Air and the Atmosphere – Ch. 2
- Review of Airfoil Theory – Ch. 3
- Boundary Layer and Flow Separation – Ch. 3
- Wind tunnels and Airfoil Characteristics – Ch. 3
- Wing Theory – Ch. 4
- Empirical Wing Characteristics – Ch. 4
- Airfoil Selection and Wing Design – Ch. 4
- High Lift Devices – Ch. 4
- Aircraft Aerodynamics – Ch. 4
- Propeller Theory – Ch. 5
- Compressible Flow Theory – Ch. 5
- Jet Propulsion Systems – Ch. 5
- Flight Performance – Ch. 5
- Longitudinal Stability & Control – Ch. 6
- Lateral Stability & Control – Ch. 6
- Aircraft Structure – Ch. 7
- Introduction to Aircraft Design – Ch. 8
- Sizing and Weight Estimation – Ch. 8
- Case Studies – Ch. 9

**8. Class Schedule:** Number of Sessions per week: 2  
Duration of each session: 1 hour 40 minutes

**9. Contribution of course to meeting the professional component:**

This course is part of the 25 units of technical electives required for the mechanical engineering program.

Engineering Science	2 units
Engineering Design	2 units

#### **10. Relationship of course to program objectives:**

This course relates to the program objectives by contributing to the following measurable outcomes at the level indicated for all engineering graduates:

##### Knowledge outcomes:

- an ability to apply knowledge of mathematics, science, and engineering (abet a)
- the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context (abet h)
- a knowledge of computer aided design and simulation software

##### Skill outcomes:

- an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability (abet c)
- an ability to communicate effectively (abet g)
- an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (abet k)
- an ability to visualize designs from engineering drawings
- an ability to think in a logical sequential process

##### Attitudes Outcome:

- a desire to be a flexible and adaptable team player (collaborative attitude)

**11. Prepared by:** Chivey Wu

05/2005