**AE 6015 - ADVANCED AERODYNAMICS**

**Hours:** 3-0-3

**Catalog Description (25 words or fewer):**

Introduce concepts, derivation and application of aerodynamic fundamentals. Emphasis on advanced knowledge in analysis and design of fixed-wing, launch/atmospheric return vehicles, and rotating systems.

**Prerequisites:**

AE 3030

**textbooks:**

Course notes

**Course Objectives:**

Develop advanced understanding of aerodynamic fundamentals for analysis and design of aerospace vehicles, with an emphasis on fixed-wing, launch/atmospheric return vehicles, and rotating systems. This course is the second course for the PhD qualifying exam in Aerodynamics/Fluid Dynamics. Lecture and assignment focus in the course will include introduction and practice for the qualifying examinations.

**Learning Outcomes:**

Students will

1. learn the theory, physics, and basic methods of solving aerodynamic problems;
2. understand aerodynamics from a graduate level perspective, including single-solution and open-solution problems to provide far-field transfer of knowledge to new configurations and problems of aerodynamic interest, including use of MATLAB, MAPLE, or MATHEMATICA programming;
3. develop improve engineering perspective of aerodynamics through interactive activities.

**Grading:**

Assignments: 25%

Project(s): 25%

Midterm Exam: 25%

Final Exam: 25%

**Learning Accommodations:**

If needed, we will make classroom accommodations for students with documented disabilities. These accommodations must be arranged in advance and in accordance with the ADAPTS office (http://www.adapts.gatech.edu).

**Topical Outline:**

| **Topic** | **Lecture Hours** |
| --- | --- |
| **I. Introduction and Review of Basic Aerodynamic Topics (equations, physics, tools)** | **14** |
| 1. Incompressible Aerodynamics |  |
| 1. Slender Wing/Body |  |
| 1. Subsonic Transformations |  |
| 1. Transonic Flow (Features And Approaches) |  |
| 1. Supersonic Airfoils |  |
| 1. Boundary Layers: Laminar, Turbulent And Transition |  |
| **II. Integrated Aerodynamics** | **4.5** |
| 1. Wing/Body/Fuselage Interactions |  |
| 1. Interference Drag |  |
| 1. Missile/Fin and Slender Body Aerodynamics |  |
| 1. Design Approaches |  |
| **III. Introduction to Unsteady Aerodynamics** | **6.5** |
| 1. Piston Theory |  |
| 1. Vortex Flows |  |
| 1. Separated Flows |  |
| 1. Bluff Bodies |  |
| 1. Rotating Configurations |  |
| **IV. High Angle of Attack Aerodynamics** | **4.5** |
| 1. Lift and Drag Prediction |  |
| 1. High Lift Devices |  |
| **V. Hypersonic Flows** | **13** |
| 1. Hypersonic Aerodynamic Prediction for Blunt and Sharp LE bodies: Hypersonic Shock and Expansion Relations, Local Surface Inclination Methods |  |
| 1. Viscous Hypersonic Flow and Heat Transfer |  |
| 1. High Temperature Effects |  |
| 1. CFD Methods for Hypersonic Flows |  |
|  |  |
| **Tests/Exams/Reviews** | **2.5** |
| **Total** | **45** |