

## **MECH 435: Low Speed Aerodynamics**

### **Catalog description:** 3.0 units

Flow around elementary shapes, concepts of flow circulation, lift and drag.  
Incompressible inviscid flows around thin airfoils and wings of finite span.

**Prerequisites:** CIVL 321, MATH 260, MECH 332

**Recommended:** MECH 306

### **Course objective**

For students to gain a basic knowledge of concepts needed to understand and analyze incompressible fluid flows around elementary body shapes, thin airfoils, and wings of finite span.

**Course outcomes:** Students shall be able to

1. Use the standard atmosphere to compute the airspeed of low-speed, general aviation aircraft at altitude
2. Calculate the flow field around elementary two-dimensional shapes
3. Use a simple vortex-panel program to calculate the lift versus angle-of-attack curve for airfoils of an arbitrary shape

### **Topics covered**

1. Review of fluid properties, fluid statics, conservation laws, constant property flows, Bernoulli equation, boundary layer concept, Mach and Reynolds numbers as similarity parameters
2. The Standard atmosphere, air speed determination, pressure coefficient, circulation, irrotational flow, stream function concepts
3. Elementary flows such as uniform, source/sink, potential vortex, and doublet; superposition of elementary flows; lift/drag coefficients as flow-field parameters; flow around a cylinder with and without circulation
4. Incompressible laminar and turbulent boundary layers
5. Characteristic parameters for airfoil and wing aerodynamics, two-dimensional incompressible flow about wings of finite span

### **Class/Laboratory schedule**

One hundred fifty minutes of lecture per week

### **Contribution of course to meet the professional component**

This course contributes to the student's ability to work professionally in the thermal systems area.

### **Relationship of course to Mechanical Engineering Program Outcomes**

This course contributes principally to Program Outcome A.