ME 439: Applied Aerodynamics

Course description:	Aerodynamic lift and drag; circulation; boundary layers; application to subsonic aircraft wing design.
Number of credits:	3
Course Coordinator:	K. Matveev
Prerequisites by course:	ME 303
Prerequisites by topic:	1. Differentiation and integration 2. Vector operations. 3. Basic fluid mechanics.
Postrequisites:	None
Textbooks/other required materials:	John D. Anderson, Jr., *Introduction to Flight*, 7th edition, McGraw-Hill, 2011.
Course objectives:	1. To provide the students an understanding of fluid properties in the atmosphere, dimensional analysis, main aircraft components. 2. To introduce the students to methods for describing airflow around airfoils and wings and calculating lift, drag and moments. 3. To introduce students to analysis of aerodynamics effects on aircraft performance, dynamics, stability and control.
Topics covered:	1. Governing equations of fluid mechanics. 2. Elements of compressible flow. 3. Boundary layers, flow separation and computation of friction and pressure drag. 4. Elements of the potential flow analysis. 5. Airfoil theory. 6. Air properties in the atmosphere. 7. Aerodynamic characteristics of wings. 8. Airplane performance, dynamics, stability and control. 9. Propulsion systems of airplanes.
Expected learning outcomes:	1. Ability to use dimensions and units consistently. 2. Ability to apply governing equations of fluid mechanics to calculate flow rates and forces in simple flows. 3. Ability to calculate flow patterns, pressure distribution and forces in irrotational flows of simple geometry, using superposition principles. 4. Ability to evaluate aerodynamic drag. 5. Understanding of airflow around airfoils and wings in different

flow regimes and conditions.
6. Ability to calculate aerodynamic forces and moments of wings.
7. Familiarity with the variation of air properties in the atmosphere with altitude.
8. Ability to use existing analytical and approximate methods to model airplane performance, dynamics, stability and control.

Class schedule: Three 50-minute lecture sessions per week or two 75-minute lecture sessions per week for one semester.

Laboratory schedule: None

Contribution to meeting the professional component: Engineering Topics

Relationship of course to student outcomes:
3 strongly supported; 2 supported; 1 minimally supported

Student Outcomes Pre-Fall 2018 (ABET EC2000)

a	b	c	d	e	f	g	h	i	j	k
3		1		1				1		1

Student Outcomes Fall 2018 forward (ABET EC2019)

1	2	3	4	5	6	7
3						1

Prepared by: Amy Johnson and K. Matveev *Date*: December 20, 2018