COURSE NUMBER	**ME 451**
COURSE TITLE	**Introduction to Aerodynamics**
COURSE STRUCTURE	(3-0-3) (lecture hr/wk - lab hr/wk – course credits)
COURSE COORDINATOR	P. Singh
COURSE DESCRIPTION	This course introduces the student to the basic principles and properties of fluid flow around immersed bodies. Topics include the kinematics and dynamics of fluid fields, the thin airfoil, finite wing theory, and one-dimensional compressible flow.
PREREQUISITE(S)	ME 304 – Fluid Mechanics ME 311 – Thermodynamics I
COREQUISITE(S)	None
REQUIRED, ELECTIVE OR SELECTED ELECTIVE	Elective
REQUIRED MATERIALS	Kuethe and Chow, Foundations of Aerodynamics, 5th Ed., J. Wiley.
Other supplemental materials (not Required)	None
COMPUTER USAGE	Matlab used for data

COURSE LEARNING OUTCOMES/ EXPECTED PERFORMANCE CRITERIA:

Course Learning Outcomes	SOs*	Expected Performance Criteria
1 **describe** the role of circulation in lift generation, and basic airfoil shapes that result in the generation of circulation	a,e,k	**Exam Question** (80% of the students will earn a grade of 75% or better on this question)
2. **apply** the Bernoulli's equation for irrotational flows to calculate the pressure distribution on the surface of a body	a,e,k	**Exam Question** (80% of the students will earn a grade of 75% or better on this question)
3. **calculate** the force acting on a body	a,c,e,k	
4. use the principle of superposition of flows to construct complex flows	a,e,k	**Homework Problem** (80% of the students will earn a grade of 75% or better on this problem)
5. use the basic source, doublet and vortex flows to construct flow around bodies, such as a source,	a,c,e,k	**Homework Problem** (80% of the students will earn a grade of

	vortex and rotating cylinder.		75% or better on this problem)
	6. calculate the lift generated by a body when circulation around it is known	a,e,k	**Exam Question** (80% of the students will earn a grade of 75% or better on this question)
	7. demonstrate familiarity with the mass, momentum and energy conservation equations for subsonic and supersonic one-dimensional compressible flows	a,e,h,k	**Homework Problem** (80% of the students will earn a grade of 75% or better on this problem)
	8. design a converging-diverging nozzle for a given Mach number.	a,c,e,k	
	9. compute the Mach number for normal and oblique shock waves	a,c,e,k	**Exam Question** (80% of the students will earn a grade of 75% or better on this question)

CLASS TOPICS

1. Physical properties of air, kinematics, and ideal fluids
2. Euler's equation, and Bernoulli's equation for irrotational flows
3. Superposition; source, doublet and vortex flows
4. Flow past bodies, thin airfoil theory, Kutta-Joukowski theorem and finite-wing theory
5. Governing equations for compressible fluids, energy relations
6. One-dimensional compressible flows
7. Flows in converging-diverging nozzles
8. Prandtl-Meyer flow and Normal shock waves

STUDENT OUTCOMES (SCALE: 1-3)

a	b	c	d	e	f	g	h	i	j	k
3		3								2

3 – Strongly supported 2 – Supported 1 – Minimally supported

* Student Outcomes