School of Engineering and Applied Science
ENSC 352
Fluid Mechanics
☒ **Required** ☐ **Elective**

AY	Revision History: Changes and Rationale	Progress Exam Affected?
07/08	Syllabus Created	N

Coordinator:	Noel Bormann, P.E., Ph.D., Professor of Civil Engineering
Catalog Description:	Fluid properties, fluid statics, fluids in motion, momentum and energy equations, dimensional analysis, boundary layers, flow in conduits, drag and lift.
Prerequisites by Topic:	ENSC 205 is the prerequisite course Statics Physics
Textbook(s) / Require Mat'l:	"Fluid Mechanics: Fundamentals and Applications". Cengel and Cimbala, 1st Ed., 2006. McGraw Hill.
Course Topics:	1. Fluid pressure and forces on submerged surfaces. 15% 2. Flow kinematics and fluid deformation, Potential flow. 15% 3. Reynolds Transport Equation for Mass, Energy, and Momentum. 20% 4. Dimensionless analysis and model similarity. 10% 5. Internal flow, flow in pipes and simple pipe systems. 20% 6. Navier-Stokes Equation. 10% 7. External flow, drag, lift and airfoils. 10%
Course Objectives:	The course will provide a introduction to calculations for the analysis of: 1. Fluid forces with no shear stress present. 2. Reynolds Transport Equation for Mass, energy and momentum. 3. Dimensionless analysis and model similarity 4. Internal flows, flow in pipes 5. Introduction to Navier Stokes Equation 6. External flows and airfoils.

Professional Components/ Course Outcomes:

By the end of this course the student will be able to:

(1) Interpret the physical significance of the components of the equations of motion for real and ideal fluids in simple cases of both external and internal flow in laminar and turbulent situations.

(2) Calculate conditions in static and flowing fluids e.g., pressure, velocity, power, stresses, net force, etc. This requires the use of the 4 fundamental relations of fluids : conservation of mass, conservation of energy, conservation of momentum and the ideal gas law, and the incorporation of viscous shear.

(3) Determine required experimental conditions using dimensional analysis. Use Similitude to predict behavior based on model measurements.

(4) Use the control volume and differential methods of analysis in applications to simple problems. Employ streamlines, determine pressure and/or velocity.

(5) Make calculations for simple pipe systems, including pipe systems that incorporate machines (i.e., pumps or turbines). This is an application of the Bernoulli Equation and The Conservation of Energy

(6) Determine basic behavior of simple shapes and airfoils (lift and drag determinations) in external flow.

Class/Lab Schedule:

3 hours of lecture each week
3 credits

Relation to Program Outcomes:

☒ (a) Fundamental math, science, or engineering		☐ (b) Experimentation
☐ (c) Design	☐ (d) Teamwork	☒ (e) Problem solving
☐ (f) Professional ethics	☐ (g) Communication	☐ (h) Global awareness
☐ (i) Life-long learning	☐ (j) Contemporary issues	☐ (k) Modern tools

Computer Tools:

Excel spreadsheets for sample computations and graphs

Laboratory Content:

none

Design Content:

Brief introduction to pipe design

Relation to Curriculum:

Curricular Component	☐ Design	☐ Math/Science
☐ Engr. M'gmt./Engr. Econ.	☐ Solid Mech./Dynamics	☒ Thermo/Fluids
☐ Engineering Computation	☐ Electrical Engr.	☐ Other Engineering
☐ Foundational	☒ Intermediate	☐ Advanced