ME 303: Fluid Mechanics

This is a cooperative course taught by WSU, open to University of Idaho students.

Course description:	Fluid statics, laminar and turbulent flow, similitude, pipe flow, boundary layers, lift and drag, and measurement techniques.
Number of credits:	3. This course is required.
Course Coordinator:	K. Matveev
Prerequisites by course:	ME 212
Prerequisites by topic:	1. Differentiation and integration. 2. Simple vector operations. 3. Concepts of velocity, acceleration, force and energy. 4. Newton’s laws of motion. 5. Basic thermodynamic concepts such as systems and properties. 6. Resolution of forces and moments from free body diagrams in statics and dynamics.
Postrequisites:	ME 305, ME 404, ME 407, ME 424, ME 439
Textbooks/other required materials:	D.F. Elger, B.C. Williams, C.T. Crowe, and J.A. Roberson. *Engineering Fluid Mechanics.* 10/e, 2012.
Course objectives:	1. Understanding the properties of fluids. 2. Calculating forces on a submerged structure in a static fluid. 3. Applying the mass conservation principle, using the control volume approach, to engineering problems. 4. Using Euler’s and Bernoulli’s equations to calculate pressure variations in accelerating fluids. 5. Applying the momentum and energy equations to engineering problems. 6. Using dimensional analysis for scaling and data reduction. 7. Calculating surface resistance in laminar and turbulent flows. 8. Evaluating head loss in pipes and conduits. 9. Calculating lift and drag on moving bodies.
Topics covered:	1. Fluid properties 2. Fluid statics 3. Fluids in motion 4. Pressure variation in flowing fluids 5. Momentum principle 6. Energy principle 7. Dimensional analysis and similitude 8. Surface resistance 9. Flow in conduits

10. Drag and lift
11. Flow measurements

Expected learning outcomes:

1. Ability to solve manometer problems, and calculate forces on submerged and floating bodies.
2. Ability to use conservation of mass principle to calculate flow rates through control volumes.
3. Ability to calculate accelerations and associated pressure variations in moving fluids using Euler's and Bernoulli's equations.
4. Ability to analyze momentum fluxes through a control volume and calculate forces in moving fluids.
5. Ability to apply conservation laws for mass, momentum and mechanical energy in combination to control volumes in ideal fluids and hence calculate hydraulic and energy grade lines.
6. Ability to calculate local and overall skin friction drag in laminar and turbulent flat plate boundary layers using approximate empirical formula.
7. Ability to solve hydraulic pipe flow problems using Moody's diagram for skin friction to calculate flow rate/ pressure loss / pipe diameter.
8. Ability to use dimensional analysis and similarity considerations in the design and interpretation of scale model experiments.
9. Ability to calculate lift and drag forces for simple aerodynamic shapes such as airfoils, cylinders and spheres using published charts of aerodynamic coefficients.

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										

Student Outcomes Fall 2018 forward
(ABET EC2019)

1	**2**	**3**	**4**	**5**	**6**	**7**
3						

Prepared by: Andrea Butcherite and K. Matveev *Date:* May 30, 2018