PURDUE UNIVERSITY FORT WAYNE | Department of Civil and Mechanical Engineering

Course	ME 31800 – Fluid Mechanics
Cross-listed Course	CE 31800 – Fluid Mechanics
Type of Course	Required for ME program
Catalog Description	Continuum hypothesis, velocity field, fluid statics, basic conservation laws for systems and control volumes, dimensional analysis and similitude, Euler and Bernoulli equations, Navier-Stokes equations, viscous flows, boundary-layer flow in channels and around submerged bodies, applications.
Credits	3
Contact Hours	3
Prerequisite Courses	ME 20000 with a minimum grade of C-, ME 25100 with a minimum grade of C-, and MA 36300
Corequisite Courses	None
Prerequisites by Topics	Thermodynamics I, Dynamics, Differential Equations
Textbook	*Introduction to Fluid Mechanics*, Pritchard, Fox and McDonald, John Wiley & Sons, current edition.
Course Objectives	To give the student 1) a foundation in the fundamentals of fluid mechanics; 2) practice in the analytical formulation of fluid mechanics problems using Newton's Laws of motion and thermodynamics; and 3) an exposure to practical applications, work on a small design project, and the writing of a technical report related to the design project.
Course Outcomes	Students who successfully complete this course will have demonstrated an ability to: 1. Know the definitions of fundamental concepts of fluid mechanics, such as velocity field, viscosity, specific gravity, and surface tension. **(1)** 2. Apply the basic equation of fluid statics to determine forces on planar and curved surfaces that are submerged in a static fluid; to manometers; and to the determination of buoyancy. **(1)**

3. Use of conservation laws in integral form and apply them to determine forces and moments on surfaces of various shapes and simple machines. **(1)**
4. Use of conservation laws in differential forms and apply them to determine velocities, pressures and acceleration in a moving fluid. **(1)**
5. Use Euler's and Bernoulli's equations and the conservation of mass to determine velocities, pressures, and accelerations for incompressible and inviscid fluids. **(1)**
6. Apply principles of dimensional analysis and similitude to simple problems and use dimensionless parameters. **(1)**
7. Determine flow rates, pressure changes, minor and major head losses for viscous flows through pipes, ducts, and simple networks. **(1)**
8. Design simple pipe systems to deliver fluids under specified conditions. **(1, 2)**
9. Understand the concept of viscous boundary layer and determine wall shear stresses and skin friction coefficients. **(1)**
10. Understand the mechanics of viscous flow about immersed bodies, as it relates to flow separation, wakes, profile drag, and drag coefficients, and the determine the drag forces exerted on such bodies. **(1)**

Lecture Topics

1. Fundamental concepts and overview
2. Fluid statics
3. Basic equations in integral form
4. Basic equations in differential form
5. Flow of an inviscid and incompressible fluid
6. Dimensional analysis and similitude
7. Internal flow of incompressible and viscous fluid
8. External flow of incompressible and viscous fluids
9. Applications: fluid machines and design project

Computer Usage Low

Laboratory Experience None

Design Experience Medium

Coordinator Donald Mueller, Ph.D.

Date 12 October 2022