1. *Course number and name*

ENGR 304: Mechanics of Fluids

1. *Credits, contact hours, and categorization of credits in Table 5-1*

3 credit hours; three 50-minute lecture sessions/week, or two 75-minute lecture sessions/week; engineering topic

1. *Instructor’s or course coordinator’s name*

Instructor and Course coordinator: Fatemeh Khalkhal, Assistant Professor of Mechanical Engineering

1. *Text book, title, author, and year*

B. C. Williams, D. F. Elger, C. T. Crowe, and J. A. Roberson. Engineering Fluid Mechanics, 12th edition, John Wiley & Sons, Inc.

* 1. *other supplemental materials*

(none)

1. *Specific course information*
2. *brief description of the content of the course (catalog description)*

Statics and dynamics of incompressible fluids, dimensional analysis, and similitude; fluid friction; laminar and turbulent flow in pipes; forces on submerged structures; fluid measurements.

1. *prerequisites or co-requisites*

PHYS 240: General Physics with Calculus III (Wave motion, optics, and thermodynamics); ENGR 201: Dynamics.

1. *indicate whether a required, elective, or selected elective course in the program*

Required for Civil and Mechanical Engineering.

1. *Specific goals for the course*
2. *specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.*

* Students will demonstrate that they understand the definition of a fluid and are familiar with properties that describe fluids.
* Students will demonstrate that they can evaluate pressure variation in a hydrostatic fluid.
* Students will demonstrate that they can evaluate hydrostatic forces on plane and curved surfaces.
* Students will demonstrate that they can evaluate buoyancy forces on immersed and floating bodies.
* Students will demonstrate that they can apply the continuity and Bernoulli equations to fluid systems.
* Students will demonstrate that they can apply the momentum equation to fluid systems.
* Students will demonstrate that they can apply the energy equation to fluid systems. Students will demonstrate that they can interpret hydraulic and energy grade lines.
* Students will demonstrate that they can identify dimensionless parameters using the Buckingham Pi theorem and dimensional analysis.
* Students will demonstrate that they can use the methods of similitude to specify the requirements for scale model tests.
* Students will demonstrate that they can analyze problems involving boundary layer theory and surface resistance.
* Students will demonstrate that they can analyze problems of laminar and turbulent flow in conduits.
* Students will demonstrate that they can analyze piping systems considering pipe friction and loss coefficients.
* Students will demonstrate that they understand the concepts of drag and lift, and are able to use drag and lift coefficients.
* Students will demonstrate that they can apply selected principles to the design of engineering systems.
* Students will demonstrate that they are familiar with common spreadsheet programs.
* Students will demonstrate that they can write a coherent technical report describing their analysis of and solution to an engineering design problem.

1. *explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.*

Course addresses ABET Student Outcome(s): 1, 2, 3, 4, 5.

1. *Brief list of topics to be covered*

* Introduction to fluids and fluid properties
* Hydrostatic pressure variation
* Pressure measurements
* Hydrostatic forces on plane and curved surfaces
* Buoyancy and stability of immersed and floating bodies
* Flow visualization
* Fluid velocity, Lagrangian and Eulerian viewpoints
* Basic control volume analysis
* Continuity equation (conservation of mass)
* Rotation and vorticity
* Pressure variation in a flowing fluid
* Bernoulli equation
* Momentum equation
* Energy equation
* Hydraulic and energy grade lines
* Dimensional analysis and similitude
* Boundary layer theory and surface resistance
* Flow in pipes and conduits
* Drag and lift