1. **Course number and name**  
   **ENGR 304: Mechanics of Fluids**

2. **Credits and contact hours**  
   3 credit hours; three 50-minute lecture sessions/week, or two 1-hr-15-minute lecture sessions/week, depending on semester

3. **Instructor’s or course coordinator’s name**  
   Instructor: Sandy Chang, Instructor  
   Course coordinator: A. S. (Ed) Cheng, Associate Professor of Mechanical Engineering

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

   a. **other supplemental materials**  
      (none)

5. **Specific course information**  
   a. **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.

   b. **prerequisites or co-requisites**  
      PHYS 240: General Physics with Calculus III (Wave motion, optics, and thermodynamics); ENGR 201: Dynamics.

   c. **indicate whether a required, elective, or selected elective course in the program**  
      Required for Civil Engineering; required for Mechanical Engineering.

6. **Specific goals for the course**  
   a. **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 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.

b. 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): a, b, c, d, e, g, h, j, k.

7. 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