Teaching and Learning Objectives of Week 1

1. Define, Illustrate, and Compare and Contrast the following terms and concepts:
   - Fields – scalar vs. vector
     - scalar: temperature, pressure, density, internal energy
     - vector: velocity, linear momentum, angular momentum
   - Flow description
     - spatial: one-, two-, three-dimensional
     - temporal: steady vs. steady
   - Conservation of mass (differential form) — continuity equation
     - for an incompressible flow
     - for a steady (steady-state) flow
   - Flow visualization
     - Pathline vs. streakline vs. streamline
   - Stream function for a 2-D incompressible flow
     - relation to V_x and V_y
     - rotation (vorticity)
     - strain
   - No-slip condition
   - Shear stress vs. normal stress
   - Viscosity
     - Newtonian vs. non-Newtonian fluid
   - Conservation of linear momentum (differential form)
     - Euler equation for an incompressible flow
     - Navier-Stokes Equations for an incompressible flow

2. Given functions describing an incompressible, two-dimensional velocity field, determine if the velocity field satisfies the continuity equation, *i.e.* is it physically possible?

3. Given an incompressible velocity field that satisfies the continuity equation, determine if the flow field is rotational or irrotational.

4. Given the general Navier-Stokes equation for an incompressible flow and a problem description, use the given information about the flow to simplify the equations to the applicable form.

5. Given the velocity profile adjacent to a wall and the viscosity of the Newtonian fluid, determine the direction and magnitude of the shear stress acting *on* the wall.

6. Explain in general terms how the continuity equation, the Euler equation, and the Navier-Stokes equations were developed from the appropriate fundamental conservation principles.

7. In ES201, you learned about the accounting principle for extensive properties and how extensive properties can be stored, transported, and generated or destroyed. Using the accounting principle, provide a physical interpretation for each term in the continuity equation, the Euler equation and Navier-Stokes equations for an incompressible flow.