Day One

- Introduction
- Piping and Tubing Standards
- Modeling of Flow in a Duct
- Description of ASME, ANSI, and ASTM standards applied to pipes and copper water tubes; methods of attaching fittings to pipes and tubes
- Modeling of Flow in a Duct
- Derivation of equation of motion; solution for laminar flow
- Friction Factor and Pipe Roughness
- Combination of laminar flow results with definition of friction factor to obtain relationship between friction factor and Reynolds number
  - Extension to turbulent flow and discussion of Moody Diagram
- Classic pipe flow example problems are solved in which pressure drop, flow rate or diameter is unknown
- Minor Losses
  - Losses through ducts are modeled as well as how the equation of motion is applied to such problems.
- Optimization Methods and Examples
- Economic Pipe Diameter

Day Two

- Piping System Cost Comparison
- Installed piping costs, including fittings, pumps or fans, pipe hangers.
- Costs Associated with Flow in a Duct
- Operating costs related to energy costs required to move fluid through a duct
- Pipe Size Selection;
  - First plus operating costs are combined into one expression which is then used to determine the pipe diameter that minimizes these costs - the Least Annual Cost Method of pipe size selection
- Modified Moody Diagrams
  - Three additional graphs of the friction factor-Reynolds number type are presented
- Piping System Curve
• Pumps
• Performance Map
• Dimensional Analysis of Pump
• Design Practices and Final Example
  - Piping System Design Practices
  - Design Procedure