1. Course number and name
MEEG 331, Fluids I
Fall Semester 2013

2. Credits and contact hours
3 credits, contact hours

3. Instructor’s or course coordinator’s name
Ajay K. Prasad, Mechanical Engineering
Date: January 8, 2014

4. Required Textbook

5. Specific course information
Catalog Data
Incompressible fluid mechanics: fluid statics, control volume analysis for mass, momentum, and energy; differential analysis of viscous and inviscid flow; dimensional analysis.

Prerequisites
MEEG112 (Statics) and MATH351 (Engineering Mathematics I)

Required undergraduate course

6. Specific goals for the course
Specific outcomes of instruction
This is the first of two required courses in fluid mechanics. It begins with a description of relevant fluid properties, and covers topics related to fluid statics and dynamics. Possible flow situations include pressure distributions and forces on submerged and floating objects, estimating shear forces between sliding surfaces, applying conservation of mass, determining forces on objects due to external or internal flows, determining energy losses due to fluid flow, applying Bernoulli’s equations to a variety of engineering problems, solving simple flows using differential equations, and conducting dimensional analysis to study relationships between flow parameters. In a concurrent laboratory course MEEG333, students perform experiments that reinforce concepts being studied in class.

Student outcomes
This course allows the students to have solid understanding of fluid mechanics, which can be used to develop a professional career in many engineering fields such as conventional and renewable energy, transportation, biofluids, and environmental engineering. Assigned outcomes for 2013-2014:

- **Outcome h**: the broad education necessary to understand the impact of engineering solutions in global and societal context
- **Outcome j**: a recognition of the need for an ability to engage in life-long learning
7. Topics

Fluid properties: density, viscosity, surface tension, bulk modulus, thermal expansion coefficient.

Pascal’s law, manometry, pressure transducers, forces on submerged surfaces, buoyancy forces, stability of floating objects.

Control volume approach; conservation of mass, momentum, and energy; Bernoulli’s equation, mechanical energy equation, forces on objects due to fluid flow, conservation of angular momentum, turbomachinery.

Differential equations for fluid mechanics: rotation, stretching, and shear for a fluid particle. Differential continuity equation, Euler equation, Cauchy equation, Navier-Stokes equation, simple flow solutions.

Dimensional analysis, Buckingham Pi theorem, scaling from model to prototype.