Course Name:
Fluid Mechanics

Course Number:
20615

Credit:
3

Prerequisite:
Statics
Corequisite:
Solid Mechanics 1

Course Description (Objectives):

The purpose of this course is to present the basics of Mechanics of fluids and familiarize the undergraduate students in civil engineering with theoretical and experimental methods in fluid mechanics. The course will expose the students to practical applications and teach them how to formulate a fluid mechanics problem and apply the basic laws of conservation of mass, momentum, and energy to come up with an understanding of the fundamental processes.

Course Content (outline):

- Introduction to fluids and their properties
- Hydrostatics: pressure, piezometers, hydrostatic forces on surfaces and bodies, buoyancy, stability of submerged and buoyant bodies
- Basic laws of fluid motion: Lagrangian and Eulerian views, definitions of various flows, conservation of mass, momentum, and energy (Bernoulli's equation), derivations of the basic laws in differential and integral forms, applications
- Dimenional analysis: Buckingham's Pi-theory, role of dimensional analysis in experimental (laboratory and numerical) fluid mechanics, similitude: applications and techniques, physical models of hydraulic structures
- Friction in fluid motion: basics of laminar and turbulent flows, derivation of Navier-Stokes equations, friction flow in channels: Chezy equation, friction flow in pipes: Darcy-Weisbach equation, solution of Navier-Stokes equations for laminar flow in pipes and between plates, turbulent flow,
- Pipes: Moody diagram and applications, minor losses, piping systems (parallel and series pipes), design of pipes, pumps
- Boundary layer: concept and properties, solution of laminar and turbulent boundary layers over a plate

- Fluid forces on objects: lift and drag forces; form and skin-friction drags; separation, wake, and vortex shedding in friction flow over a cylinder, drag reduction methods

References:

- Fluid Mechanics, Victor L. Streeter et al., 9th edition, McGraw-Hill, 1997.
- Fundamentals of Fluid Mechanics, B. R. Munson, A. P. Rothmayer, T. H. Okiishi, and W. W. Huebsch, 7th Edition, John Wiley & Sons, 2013.