كلية الهندسة

ME222 Fluid Mechanics (Required Course)

Code and Name: ME222 Fluid Mechanics
Credit Hours: 3 (Lecture: 3, Tutorial: 1)

Textbook:
- Engineering Fluid Mechanics, D.F. Elgar, B.C. Williams, C.T. Crowe, and J.A. Roberson, 10th Edition, John Wiley & Sons, Inc., 2014.

Other References:
- ASME monthly magazine, 'Mechanical Engineering", http://ocw.mit.edu/courses/mechanical-engineering/

Course Description:
Fluid statics, conservation of mass, momentum and energy in fixed and moving control volumes, steady and unsteady Bernoulli's equation. Differential analysis of fluid flow, dimensional analysis and similitude, laminar and turbulent flow. Boundary layers, lift and drag.

Pre-requisites: ME201 Statics, ME221 Thermodynamics-I, MATH235 Differential Equations.
Co-requisites: None

Course Learning Outcomes:
With relation to ABET Student Outcomes (SOs: 1-7)

1. Develop physical understanding of various fluid properties such as density, specific gravity, viscosity, buoyancy etc. (1)
2. Formulate and solve fluid mechanics problems. (1)
3. Understand and demonstrate how mass, momentum and energy is conserved in fluid systems. (1)
4. Show the effect of pressure as well as fluid and surface resistance on the velocity profiles in fluids. (1)
5. Explain the buoyancy, hydrostatic forces and stability of floating objects. (1, 2)
6. Explain the significance of dimensionless groups in the analysis of fluid mechanics problems. (1, 2)
7. Differentiate between laminar, transition and turbulent flows. (1)
8. Explain various problems encountered in fluidic systems such as cavitation, water hammer etc. (1)

Topics to be covered:

- Basic definitions, units and fluid properties
- Hydrostatic forces on plane and curved surfaces. Buoyancy and stability of floating bodies
- Velocity and flow description, fluid acceleration, the Euler's equation, pressure distribution in rotating flows. The Bernoulli Equation, rotation and vorticity, the Bernoulli equation in irrotational flow.
- The rate of flow, the control volume approach, continuity equation, differential form of continuity equation, cavitation.
- The momentum equation and its applications, water hammer. Moment of momentum equation and its applications, Navier-Stokes Equation.
- Energy, Work & Power, Energy equation for pipe flow, power equation, hydraulic and energy grade lines.
- Dimensional analysis and its need, Buckingham-Pi theorem, common groups, similitude
- Surface resistance and boundary layer flow. Laminar, transition and turbulent boundary layers. Pressure gradient effects in boundary layer flow.
- Shear stress distribution, laminar and turbulent flow in pipes, pumps and piping systems.
- Theory of lift & drag and its relationship to stress distribution. Lift & drag on airfoils and automobiles.

Grading Policy:
The grading for the course are 60% coursework and 40% Final Exam. The course work consists of two Midterm Exams, where each midterm exam is worth 20%. It also includes quizzes, homework, and projects for the remaining 20% that is modified by the course instructor.