Course Number	**ME 304**
Course Title	**Fluid Mechanics**
Course Structure	(3-0-3) (lecture hr/wk - lab hr/wk – course credits)
Course Coordinator	I.J. Rao
Course Description	Introduction to basic principles of conservation of mass, momentum, and energy as they apply to engineering systems which utilize fluids. Some of the topics studied are: dimensional analysis, theoretical and empirical analysis of one dimensional incompressible flows, empirical analysis of external and internal flows, and elementary boundary layer theory.
Prerequisite(s)	Mech 236 – Dynamics II, ME 311 – Thermodynamics
Corequisite(s)	None
Required, Elective or Selected Elective	Required
Required Materials	B. R. Munson, D. F. Young, T. H. Okiishhi's. Fundamentals of Fluid Mechanics, *by Philip M. Gerhart, Andrew L. Gerhart, John I. Hochstein* 8th Edition, Wiley, NY, 2016.
Supplemental materials (not Required)	None
Computer Usage	Some problems may require use of software such as MATLAB or MathCad.

Course Learning Outcomes/ Expected Performance Criteria:

Course Learning Outcomes	SOs*	Expected Performance Criteria
1 **evaluate** surface forces and pressure difference for a static fluid	1,4	**Exam Question** (70% of the students will earn a grade of 70% or better on this question)
2. **apply** the mechanical energy equation to a variety of physical systems.	1,2,4	**Exam Question** (70% of the students will earn a grade of 70% or better on this question)
3. **apply** the integral form of conservation laws to a variety of flows problems and obtain engineering design quantities, such as reaction forces and velocities.	1,2,4	**Exam Question** (70% of the students will earn a grade of 70% or better on this question)

	4. **form** dimensionless groups and apply the resulting modeling laws to experimental data as well as a variety of engineering problems	1,4	**Exam Question** (70% of the students will earn a grade of 70% or better on this question)
	5. **apply** the Navier-Stokes Equations to simple flows in planar and cylindrical geometries, solve for velocity and flow rate	1,4	**Exam Question** (70% of the students will earn a grade of 70% or better on this question)
	6 **calculate** engineering design quantities (shear stress, losses, volumetric flow rates, pressures, pumping power) for laminar and turbulent flows in pipes.	1,2,4	**Exam Question** (70% of the students will earn a grade of 70% or better on this question)
	7. **evaluate** the drag characteristics and boundary layer parameters for laminar as well as turbulent flow	1,2,4	**Exam Question** (70% of the students will earn a grade of 70% or better on this question)
	8. **calculate** the drag coefficient that is applicable to a variety of flow situations	1,2,4	**Exam Question** (70% of the students will earn a grade of 70% or better on this question)

Class Topics

1. Definitions, fluid properties
2. Fluid statics. Pressure variation and its application in manometry and resultant forces on planer and curved surfaces.
3. Flow patterns. Streamlines, pathlines, etc. Eulerian and Lagrangian descriptions. Fluid acceleration, local and convective.
4. Control volume analysis: Application of continuity, momentum and energy equations.
5. Differential analysis.
6. Euler's and Bernoulli's equations and application.
7. Dimensional analysis: Dimensionless parameters and model studies (3hrs)
8. Internal flows: Laminar and turbulent pipe flows.
9. Boundary layer concepts, laminar and turbulent flows.
10. Drag: Drag on two-dimensional bodies.

Student Outcomes (Scale: 1-3)

1	2	3	4	5	6	7
3	1		1			

3 – Strongly supported 2 – Supported 1 – Minimally supported

* Student Outcomes