Northeastern University
SPCS Lowell Institute School
Fluid Mechanics IETM 4531
Spring 2006

Instructor: Richard Whalen
Office / Phone: 311Sn / 373-4706
Email: r.whalen@neu.edu
Web site: www.coe.neu.edu\~whalen
Office hours: M & TH 3:30 - 4:30, W 11:45-12:45
Text: Mott, Robert, "Applied Fluid Mechanics", 6th Edition, 2004.

Catalog Description: Examines hydrostatics; principles governing fluids at rest; pressure measurements; hydrostatic forces on submerged areas and objects; simple dams; and fluids in moving vessels. Discusses fluid flow in pipes under pressure; fluid energy; power, and friction loss; Bernoulli's theorem; and flow measurements. Explores pipe networks and reservoir systems, flow in open channels, uniform flow, energy, friction loss, minor losses, and velocity distribution. Topics include alternate stages of flow, critical flow, nonuniform flow, and accelerated and retarded flow.

Prerequisites: Dynamics

Course Outcomes:
1. To understand the importance of proper dimensional units for parameters that are used in the formulae of fluid dynamic equations,
2. To be able to understand viscosity as a property of a fluid, use the textbook Tables and figures to determine its value for a specific fluid and apply the basic formula to solve for stresses or forces as applied to surfaces in motion relative to each other,
3. To be able to understand and apply Pascal's Law to static columns of fluids particularly in order to determine the operation of manometers in finding absolute or differential pressures,
4. To be able to determine the magnitude and location of the total force on submerged flat or curved surfaces,
5. To be able to determine the Center of Buoyancy and apply the stability criteria for a floating object,
6. To be able to establish a Control Volume (CV) for a fluid system in preparation of applying Bernoulli's Equation or the Energy equation for a fluidic stream,
7. To be able to apply Bernoulli's Equation and the complete Energy Equation for fluidic systems which includes friction energy losses for fittings and lines as well as the inclusion of pump and expander/turbine energy,
8. To be able to use the Moody Diagram to determine the pipe friction coefficient using the calculated Reynold's number of the fluid stream,
9. To understand the basic operation performance characteristics of centrifugal and positive displacement pumps as well as of fans and blowers,
10. To understand the basic operation performance characteristics of flow measuring device and the use of the basic equations that calculate mass flow rate based on Bernoulli's Eqn.,
11. To be able to understand and use the affinity laws for pumps and fans as well as

manufacturer's specifications (i.e. cut-sheets)

Major Topics:

1. Nature of Fluids. Pressure.
2. Forces on Submerged Surfaces. Buoyancy and Stability.
3. Flow of Fluids, Continuity Equation, and Bernoulli's Equation.
4. General Energy Equation. Laminar Flow, Turbulent Flow, and Velocity Profiles.
5. Energy Losses Due to Friction. Series / Parallel Pipe Systems. Open Channel Flow.

Student Evaluation:

1.	Exams (2)	60%
2.	Final Exam	40%

Student Obligations:

1. Attendance is essential.
2. Homework will not be collected but must be done in order to succeed in this course. Weekly HW will be assigned on Monday and will be due the following Monday
3. Adequate preparation for exams and completion of laboratories.

TENATIVE SCHEDULE
IETM 4531

WEEK	TOPIC
1	Nature of fluids; Viscosity; Pressure due to static fluids.
2	Forces on submerged surfaces; Concept of piezometric head.
3	Forces on curved surfaces.
4	Buoyancy and Stability. Examination 1.
5	Flow of fluids continuity equation; Bernoulli's equation.
6	General energy equation for steady flow;Laminar and turbulent flow;Velocity Profiles.
7	Friction Factor and the Moody Diagram.
8	Minor Losses. Examination 2
9	Series Pipe Networks.
10	Parallel Pipe Networks.
11	Open Channel Flow, Pump Selection
12	Final Exam

#	HOMEWORK ASSIGNMENTS
1	2.61, 3.17, 3.33, 3.39, 3.41, 3.49, 3.55, 3.65, 3.68, 3.71
2	4.12, 4.14, 4.15, 4.21, 4.25
3	4.50, 4.51, 4.55
4	5.8,5.12, 5.27, 5.37, 5.41, 5.55, 5.59
5	6.41,6.45, 6.63,6.66, 6.79,6.90,6.99
6	7.21, 7.30, 7.42, 7.44, 8.8, 8.28, 8.31, 8.37, 8.38
7	9.5, 9.12, 9.17, 9.31, 9.40
8	10.23, 10. 32, 10.39, 10.41, 10.45
9	11.7, 11.16, 11.20, 11.22
10	12.1, 12.5, 12.6, 12.7
11	14.11, 14.20, 14.36, 14.37, 14.38, 14.39
12	13.2, 13.4, 13.8, 13.9

Tentative Lab Schedule
Viscosity Experiment (Basement Fr)
Velocity Profiles (Mugar Chem. Eng. Labs)
Manometer Experiment or Cascade Flow (Mugar Chem. Eng. Labs or Richards Basement MIME Dept. Labs)