

**CE 362
Hydraulics
Winter 2005**

Course objective:

Apply of the basic principles of fluid mechanics to problems in the analysis and design of hydraulic engineering systems including pressurized closed conduit flow, turbomachinery and open channel flow.

Prerequisite: EAS 361, Fluid Mechanics or the equivalent

Place and time: Lecture: TR, 8:30 – 9:45, room 155, SBII
Labs M, 1300 – 1430, room 125, SBII
M, 1430 – 1700, room 125, SBII
W, 1300 – 1430, room 125 SBII

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Texts: Computer Applications in Hydraulic Engineering, 6th Edition
Available from: <http://www.haestad.com/library/books/caihe/>
Haestad Methods, Inc., 2004
(also used in CE 364, Water Resources Engineering, Sp 04)

Fundamentals of Fluid Mechanics, 4th Edition
Munson, Young and Oshiki
John Wiley, New York, 2002
(text for EAS 361, Fluid Mechanics, F03)

Software: Academic CD by Haestad Methods including
FlowMaster (steady flow in closed conduits and open channels)
WaterCAD (steady flow in pipe networks)
Other writing, calculation and graphics software as required, e.g.
Word-processing
Spreadsheet

Grading structure:

Midterm	30%
Final	40%
Weekly homework	10%
Experimental lab and reports (3)	10%
Computational lab and reports (3)	10%

Other details:

1. Homework will be assigned on Tuesday, due the following Tuesday. No late homework will be accepted.
2. Lab is a required part of the course. Attendance is required at all scheduled lab periods to receive a grade for that period. Lab reports are due the following week at the beginning of the lab period.

Course outline

1. Pressurized closed conduit flow
 - Viscous flow
 - Laminar flow, characteristics and velocity distribution
 - Turbulent flow, characteristics and velocity distribution
 - Reynolds number and flow classification
 - Energy losses
 - Losses due to friction
 - Darcy-Weisbach equation
 - Hazen-Williams equation
 - Minor (form) losses
 - Determination of head loss, flow and diameter for simple pipe systems
 - Conduits with noncircular cross-sections
 - Compound pipeflow systems
 - Pipes in series
 - Pipes in parallel
 - Branching pipes
 - Pipe networks

2. Turbomachinery (primarily pumps)
 - Centrifugal pump characteristics
 - Homologous Units - similarity considerations
 - Net positive suction head
 - Pump systems: series and parallel
 - Pumps in pipe systems: calculation of flow, power requirements

3. Flow in open channels
 - Steady uniform flow - force balance and basic equation
 - Energy losses - equations of Chezy and Manning
 - Normal depth and its calculation
 - Energy considerations (e.g. specific energy, critical depth, flow transitions)
 - Gradually varied flow (GVF)
 - Flow classification
 - Calculation of GVF
 - Momentum considerations (specific force)
 - Rapidly varied flow - the hydraulic jump.