<u>CE 312 HYDRAULIC ENGINEERING I</u>

Required Course Spring 2009

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	Office Hours	: M T W Th 3	M T W Th 3
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Course Data:	Hours:	MM 12, WW12	
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Course Description (Catalog):

CE 312 Hydraulic Engineering

A quantitative introduction to the principles of hydrology, hydraulics and water resources planning for design and analysis of systems concerned with the use and control of water, storage, water transmission; design of open channels and pressure conduits. Ground water engineering, economical analysis of water resources projects.

Prerequisite: 311 Fluid Mechanics or approved equivalent.

Course Objectives (Learning Outcomes):

To establish an understanding of the fundamental concepts of hydraulic engineering.

To discuss the basic fluid principles underlying modern approaches for design of various types of pipe networking

To build the necessary theoretical background by hydraulic laboratories.

Textbook:

Hwang, N.C.H. and Houghtalen, C.E., "**Hydraulic Engineering Systems**", 3rd Ed., Prentice-Hall, 1996. Munson, B.R., Young, D.F.; Okiishi, T.H., "**Fundamentals of Fluid Mechanics**", 5th ed.., Wiley, 2006. **Reference Books:**

Chow, V.T., "Open Channel Hydraulics", McGraw-Hill, 1959.

Henderson, F.M., "Open Channel Flow", MacMillan, 1966.

Curricular Context

This required course constitutes a transition from fundamental math and science topics to specific applications within the context of fluid mechanics and hydraulic engineering. It provides the foundation for advanced hydraulic engineering.

Laboratory and Computer Usage:

Laboratory scheduling will take place during the first weeks of the semester. You ere expected to have read about the experiment before the laboratory session. Each group should have the data sheets filled out in ink and signed by the laboratory assistant before leaving the laboratory. The lab reports should be prepared using appropriate word-processing and plotting software. Although each group is expected to submit a single report, all members of the group are responsible from all aspects of the experiment and the report. There will be a laboratory final exam at the end of the term.

Class Policies:

Laboratory& its exam (%15) and Quizzes (%10): Unannounced quizzes to be held almost weekly. Quizzes will be based on class content..

Midterm exams: Two exams, each 25% of the course grade.

Final exam: Comprehensive exam at the end of the semester, 25% of the course grade.

Contribution of the Course to Program Outcomes:

(a) An ability to apply knowledge of mathematics, science and engineering

(e) An ability to identify, formulate and solve engineering problems

(k) An ability to use the techniques, skills and modern engineering tools necessary for engineering practice **Course Assessment:**

Course will be assessed on the basis of the accomplishments regarding the course objectives and the contributions to the program outcomes. The evaluation will consist mainly of the responses from the students, who will provide their comments to various course related questions in the final week of the semester.

(3+2+0)4

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Week	Topics	Reading Assignment	Content
1 2 3	Introduction Viscous flow in pipes	Chapters 8 MYO	Syllabus and administrative matters. Overview of subjects and motivation. Characteristics of viscous flow, NS equations and boundary conditions, fully developed laminar flow, velocity profiles in pipe flow, examples of solution Energy considerations in pipe flow, major losses for laminar and turbulent flow, dimensional analysis, D'Arcy-Weisbach equation, Moody diagram, Colebrook-White equation, Swamee-Jain equations, minor losses (junctions, valves, etc.) Empirical equations (Hazen-Williams, Manning), hydraulic and energy gradeline, equivalent length concept General classification, single pipe systems, problem types, examples Multiple pipe systems, pipes in series, equivalent pipes, example, vapour pressur
4	Analysis of pipe flows	Chapter 3 HH Chapters 8, MYO	Parallel pipe systems, example Branching pipe systems, example
5	Pipe Networks	Chapter 3, HH	Definition, conditions for solution, method of solution, common pipes, inclusion of minor losses
6 7 8 9 10	Pipe Networks Waterhammer Theory Pumps Pump Selection Open Channel Hydraulics	Chapter 4-6 HH Chapters 10 MYO	Inviscid, simplified theory, differential equations Waterhammer example, surge tanks Classification, centrifugal pumps, efficiency, axial flow pumps, jet pumps Criteria for selection, selection charts, characteristic curves, example, connection of pumps (series, parallel, combined) Introduction, classification, flow resistance, uniform flow, empirical equations (Chezy, Manning), normal depth, hydraulic efficiency, best hydraulic section, channel cross sections Pressure modification due to bottom curvature, energy principle, specific energy, specific energy curves, critical flow Classification based on Froude number, depth transition, determination of critical depth discharge curves, chokes Examples, critical flow and controls, hydraulic jumps, classification
12	Uniform Open Channel Flow	Chapter 6 HH Chapters 10 MYO	Determination of water surface profiles, the direct step method
13	Gradually Varied O.C. Flow	Chapter 6 HH Chapters 10 MYO	Determination of water surface profiles, the direct integration method .
14	Review	Chapter 6 HH Chapters 10 MYO	