University of Louisville
J.B. Speed School of Engineering
Department of Civil & Environmental Engineering

CEE 370-01 Engineering Hydraulics (Class number: 2703) Spring Term 2014

Catalog Description: A study of the fundamental principles of hydraulics, including fluid statics, kinematics, and dynamics. Application of basic concepts and principles to fluid flow through pipes, open channels, turbomachines, and flow measurement.
Prerequisite: CEE254, ME 206, concurrent registration in CEE 371

Schedule: 9:00 - 9:50 am, M W F, WS 108

Instructor: Prof. Mark French. PhD, PE, 121 W.S. Speed Hall, 502-852-0144, Mark.French@louisville.edu
Office Hours: Tuesday, Friday: 2:00-3:30pm or anytime by appointment

Course Texts:
1. *Fluid Mechanics*, 7th ed., Frank M. White, McGraw-Hill, ©2011 – ISBN-9780073529349

2. *Fundamentals of Engineering – Reference Handbook*, 8th edition, 2nd revision, ©2011 NCEES® (pdf ncees.org)

Topics in this course are basic to Civil and Environmental Engineering professional practice. Most of what you will learn is necessary information for continuing into professional engineering to pass the exams necessary to obtain your license to practice professional engineering – this means passing the FE exam and the PE exam. The FE and PE exams are similar in concept to those required of MDs (boards) and JDs (bar). The overall goal of this course is to prepare you for professional engineering practice and passing the FE exam topics related to fluid mechanics and hydraulics – to meet this goal there are several objectives we will address and course outcomes you must meet.

Course announcements, homework assignments, and grades are posted to the Blackboard on-line system.
You must access blackboard information regularly to review course documents and verify your individual assignment grades.
Blackboard system email is used to notify you of course information and assignments.

Course Objectives:

This course is designed to provide you with an understanding of the methods and procedures for engineering analysis of water in both static and dynamic environments. Your involvement and participation in the learning process is essential and required for successful accomplishment of the course objectives.

Specific objectives for class meetings are presented at the beginning of each class meeting time – these are the things you must know or take-away from each class. The overall course objectives are:

I. Know the characteristics and properties of water to analyze and solve civil engineering problems.
II. Know how to describe and solve civil engineering problems in hydrostatics.
III. Know how and when to apply conservation of mass, conservation of momentum, and conservation of energy to civil engineering hydrodynamics.
IV. Know how hydraulic experiments and model analysis are designed and applied to full-scale settings.
V. Know how to analyze pressurized pipe flow hydraulics with energy loss and friction using the Moody chart.
VI. Know how to account for boundary layer flows and drag for hydraulic analysis.
VII. Know how to describe uniform flow in open channels and apply Manning equation for analysis.

Course Evaluation & Grading:

4 – In-class tests 4@100 pts each	400 points	73 %
5 – Quizzes in-class or take-home work 5@20 pts each	100	18
tbd – Graded homework and In-class problem solving (scaled to 50 total)	50	9
1 – Final Exam (optional) 200 points – re-scale course grade % using 750 total		
Total:	550 points	100 %

The following scale assigns letter grades:

A+ > 95%, A > 90%, B+ > 85%, B > 80%, C+ > 75%, C > 70%, D+ > 65%, D > 60%, F < 60%

Late assignment grading and make-up policy:
- Any assignment is deducted 10% for each 24-hour period late (weekend counts as two 24-hour periods)
- After 5 days assignments receive a zero grade - unless prior approval for delay in completing is granted
- Assignments, except tests and exams, can be re-submitted for make-up score within 5 days of posted grade. Maximum make-up is one-half amount deducted. You must notify me at the time you re-submit any assignment.

CEE 370-01 Engineering Hydraulics Course Schedule			
Week	**Topic**	**Chapter Section**	**Recommended Homework Problems**
1 – 1/6	I. Intro. Hydraulics and Fluids Dimensions, Units, Properties	1.1 – 1.6 1.7 – 1.11	P1: 2, 4, FE1.1, 1.6 P1: 7, 10, 11, 13, 17, FE1.4, 1.5, 1.7
2 – 1/13	Viscosity, Surface Tension II. Fluid Statics, ΣF=0 **Quiz 1** (Friday)	1.12 – 1.14	P1: 23, 26, 38, 44, 45, 46, 47, 65, 70, 74, FE1.9, C1.7
3 – 1/20	*M. L. King Holiday* (Monday) Pressure Gradients & Distribution Manometers & Hydrostatic Pressure **Quiz 2** (Friday)	2.1 – 2.4 2.4 – 2.5 2.5	P2: 2: 3, 5, 6, 7, 12, 14, 18, FE2.1, 2.2 20, 23, 30, 32, 35, 36, 44, FE2.4, W2.1 P2:50, 54, 56, 58, 60, 61, FE2.6 P2: 66, 70, 73, 82, 83, 85, 88
4 – 1/27	Forces on plane surfaces **Test 1 (Friday)**	2.5 **1, 2**	P2: 91, 92, 96, 104, 105, C2.2
5 – 2/3	Forces on curved surfaces, Buoyancy III. Fluid Dynamics, ΣF=ma Reynolds Transport Theorem Control Volume: Conservation of Mass	2.6, 2.8 3.1 – 3.3 3.3	P2: 110, 111, 113, FE2.9 P3: 4, 8, 12, 13, 14 P3:19, 20, 23, 28 P3:32, 36, 38, 40, 42, 43, 49, 54
6 – 2/10	**Quiz 3** (Wednesday) Conservation of Momentum Conservation of Energy	3.4 3.4, 3.6 3.6	P3:58, 59, 60, 64, 74, 81, FE3.5 P3:102, 132, 133, 137, 141, 149 P3:157, 158, 164, FE3.2, 3.4, C3.1
7 – 2/17	**Quiz 4** (Monday) Bernoulli Equation **Test 2 (Friday)**	3.7 3.7 **3**	P3:167, 172, 176, FE3.6, 3.8, 3.10, C3.3
8 – 2/24	IV. Similitude and Modeling Dimensional analysis/numbers Force Coefficient	5.1, 5.2 5.3 5.3	P5: 1, 4, 5, 6, 8, FE5.10 P5:14, 15, FE 5.1, 5.2 P5:22, 27, 32, 48, FE5.8, FE 5.5
9 – 3/3	Pi Theorem Applications & Examples **Quiz 5** (Wednesday) V. Viscous Flow in Pipes	5.5 5.5 6.1-6.2	P5:54, 77, 78, 80, 84 P6: 4, 6, 7, 16, 19, 29, FE6.1, 6.2 P6:43, 45, 47, 55, 56, 58, 63
10 – 3/10	*Spring Break Holiday*		
11 – 3/17	Reynolds flow regimes – laminar Reynolds flow regimes – turbulent	6.4	P6:62, 67, 70, FE6.4
12 – 3/24	Reynolds flow regimes – applications **Test 3 (Friday)**	6.6, 6.10 **5, 6**	P6:76, 83, FE6.6, 6.12, 6.15, P6:111, 115, 116, 124, 154
13 – 3/31	Minor Losses & Multiple pipes VI. Boundary-Layer Flows	6.7 6.9 7.1, 7.2	P6:100, 103, FE6.5 P6:109, FE6.11 P7: 1, 4, 5 , FE7.1
14 – 4/7	**Quiz 6** (Monday) Drag Force submerged flow Stokes Law	7.4 7.6	P7: 56, 57, 58, 62, 72, 88, FE7.2, 7.3 FE7.6, 7.7, 7.8, 7.9, C7.1, C7.3
15 – 4/14	VII. Open-Channel Flow Chézy-Manning Formula **Test 4 (Friday)**	10.1-10.2 10.3 **6, 7, 10**	P10: 4, 11, 14, FE10.1 P10:17, 19, FE10.3 P10:20, 33, FE10.4, 10.5
16 – 4/21	Last day of classes – (Monday)		Final Exam Review
	4/25 Test 5 - Final Exam: Friday, April 25, 08:00AM - 10:30AM		Chapters 1, 2, 3, 5, 6, 7, 10

Important Dates:

January 20 (Monday)	Martin Luther King Holiday
March 6 (Thursday)	Last day to drop a class without academic penalty
March 10-14 (Mon-Fri)	Spring Break
April 21 (Monday)	Last day of classes
April 25 (Friday)	Final Exam**,** 08:00AM - 10:30AM (louisville.edu/registrar/finals.html)

Course Overview and Perspective:

Assignments and grades are posted on the Blackboard System –check regularly to verify your grades.

Scheduled office hours are listed in the syllabus. I have an 'open-door' policy for answering questions – this means, outside of office hours, I welcome you to stop by and knock on the door anytime, I'll meet with you if possible. Finally, if you need to meet at a specific time, I can set an appointment with you.

Bring your course textbook, pencil or pen, calculator, and paper to each class meeting – a portion of your in-class participation is based on you having these items available for use.

You are required to complete and understand the recommended homework problems. In-class problems are collected as a part of your participation grade – and may be collected in place of a quiz. Quiz and exam problems are modeled from assigned reading, problems, and course objectives. You are encouraged to work with other students to complete assigned problems. You should attempt and learn how to explain every problem and outline the steps of your solution.

Readings and review of book information is an important part of what you want to learn. The Author of your primary course book, Prof. F.M. White, is a research engineer with experience in the field of fluid mechanics and engineering hydraulics. This book contains a complementary set of engineering analyses and explanations, applied example problems, and problems for you to complete to learn the material.

The second book required for the course is the National Council of Examiners for Engineering and Surveying (NCEES) *Fundamentals of Engineering – Reference Handbook,* available free in .pdf format from the NCEES® website: www.ncees.org.

ABET and ASCE outcomes and objectives:

The UofL Bachelor of Science in Civil Engineering degree is accredited by the Accreditation Board for Engineering and Technology (ABET, abet.org). Each course you complete at the J.B. Speed School of Engineering is a component of a comprehensive academic training program leading to a degree certifying your scholastic foundation for entering the professional practice of civil engineering. Each course contributes a part to the overall accreditation, and likewise, an individual course does not contribute to all the learning objectives of your degree.

The UofL Master of Engineering degree in civil engineering is ABET accredited at the advanced-level. At this time, UofL is the only engineering school in the U.S. achieving advanced-level accreditation. In order to meet this higher standard, several additional objectives beyond the undergraduate level must be met in the degree curriculum.

Academic Honesty and Integrity (text follows from the Speed School code of conduct document):
Students are expected to demonstrate honesty and integrity in all aspects of their education and in their interactions with students, staff and faculty. They may not cheat, plagiarize, or assist others in the commission of these acts. The student is bound to know, understand, and preserve professional ethics and has a duty to report any breach of these ethics by other students through the appropriate channels.

Any student submitting work containing copied or duplicated work, in part or entirety, will immediately receive an F grade for the course and will be expelled from the course.

Do not distribute or loan copies of your work or assignments (including computer files).

Do not leave copies of your work or computer files in public or on public computers in a computer lab.
You are responsible if a person turns in a copy of your work as their own.

University-wide student code of conduct, University Policies, and details of student academic integrity for Speed School is available at: louisville.edu/speed/academics/academic-affairs/engineering-fundamentals/student-affairs

For additional assistance: louisville.edu/studentadvocate

Students with Disabilities:
Students with disabilities are responsible for ensuring the University is aware of disabilities that require accommodation in the educational process. The Disability Resource Center is responsible for the coordination of programs and services for qualified applicants for admission and enrolled students with disabilities. For information on note taking, reader, and

tutoring services and to find out how to apply for these support services, please visit the Disability Resource Center web page at: louisville.edu/disability/ or call 852-6938.

Civil and Environmental Engineering (CEE) Department:

The Civil and Environmental Engineering (CEE) Department delivers this course to you as a part of its contribution to teaching at the engineering school. In order to meet the expected performance goals for the department, the following mission statement exists:

CEE Mission Statement:

The mission of the Department of Civil and Environmental Engineering (CEE) is to provide the highest quality instruction, research, and service in support of the urban mission of the University of Louisville. Regarding instruction, the intent is to educate CEE students in a professional engineering school context and prepare students for a productive life-long career in the engineering profession. Secondly, the intent is to conduct research relevant to the infrastructure needs of the Commonwealth and the country. Lastly, the intent of service is to be useful to the university, the community, the Commonwealth, and the profession.

Similarly, in order to meet the educational goals for the school and department, the following program outcomes exist:

CEE Program Outcomes:

A. Develop in students an ability to apply knowledge from math, science, and engineering.
B. 1) Develop an ability to organize and conduct laboratory and fieldwork.
   2) Develop an ability to analyze and interpret data.
C. Develop student competence in the design of systems, components, and processes to meet specific needs.
D. Provide experience and guidance in working on teams, having a diverse technical makeup.
E. Train students to identify, formulate, and solve engineering problems.
F. Instill in students an understanding of professional and ethical responsibilities, both in education and in practice.
G. 1) Develop and practice effective oral communication.
   2) Develop and practice effective written and graphic communication.
H. Provide a breadth of course work and perspectives that create an understanding of the impact of engineering in society, both local and global.
I. Create awareness in students of the need for life-long learning, whether through formal education or via many other means.
J. Expose students to contemporary issues pertinent to the practice of civil engineering.
K. Through both instruction and practice, develop in students an ability to use the techniques, skills and modern engineering tools commonly used in civil engineering practice.