Water Resources Engineering
0908-342

Spring 2005
12:15 to 3:00 Monday and Friday
1:45 to 3:00 Wednesday

This course is a continuation and extension of Fluid Mechanics, with a focus on engineering applications of hydraulic and hydrologic engineering. We apply the concepts gained in Fluid Mechanics (hydrostatics, conservation laws) to analysis of pipe flows, pipe networks, turbomachinery, open channel flow, and surface and ground-water hydrology. Flow phenomena are illustrated in laboratory demonstrations and (perhaps) field trips. Written communication skills are developed through written laboratory reports and design letter reports. The course audience is primarily 3rd year engineering students with knowledge of fluid mechanics, engineering materials, and calculus. The course is a prerequisite for courses such as advanced water resources engineering, design of hydraulic structures, and environmental fluid mechanics.

INSTRUCTOR: Dr. Joe Orlins, 234 Rowan Hall, (856) 256-5328
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TEXT: *Water Resources Engineering, 2005 Edition,* by Larry Mays
ISBN: 0-471-70524-1
Supplement: *Engineering Fluid Mechanics,* by Crowe, Roberson & Elger

OFFICE HOURS: Any time my door is open; or by appointment

WEB PAGE: http://engineering.rowan.edu/~orlins/wre/

LABS: Labs will be a combination of experimental and design-based work. For each lab exercise, you must actively participate and turn in a written report to receive full credit.

GRADING:

Professional Conduct	50 points	(5%)
Homework	100 points	(10%)
Labs	200 points	(20%)
Design Projects	200 points	(20%)
Mid-term Exam	200 points	(20%)
Final Exam	250 points	(25%)
TOTAL	1000 points	

Explanation of Grading System:

Homework (10%): Puzzle and problem-solving skills are the hallmark of a successful engineer. You will be expected to complete homework puzzles before the next class period. You may work on the home problems with your colleagues, but the work you turn in must be your own. You will be expected to follow the College of Engineering Homework Format guidelines for all work done for this course; **neatness and clarity are essential** to conveying technical information to others. Credit may be reduced for unprofessional work. The homework format can be found on the course web page.

Labs (20%): You are expected to attend and participate in the experimental laboratory sessions. There will be approximately 5 lab sessions, plus (perhaps) one or two field trips. Lab reports must be written in the form of a brief report, following the proscribed format, which can be found on the course web page.

Design Projects (20%): There will be a number of design projects throughout the semester. These projects will be presented in the form of a letter from a client to an engineering company that you work for. You will be expected to develop a design solution to the client's problem, and then respond to the client with a letter report.

Late assignments will not be accepted without prior arrangement with the instructor.

Midterm Exam (20%): The midterm exam will be conducted in two parts. The first part will be an individual exam, open notes, open book. The second part will be a group exam, where you will work with other students to solve problems similar to those in the first part. The second part will also be open notes, open book.

Final Exam (25%): The final exam will be cumulative. It will be an individual exam.

Extra Credit (up to 3%): Undergraduates may receive up to 3% of their grade in extra credit by attending professional society meetings throughout the semester. You must obtain an Extra Credit form (available from the course web site), and have it signed by the faculty advisor present at the meeting. The Extra Credit form must be turned in no later than the day of the Final Exam. No extra credit will be given after the Final Exam.

Professional Conduct (5%)
You will be graded on your professionalism in this course. Many people including your fellow employees, community and family rely on your professional decisions and actions. Your work should place the highest value on safety. In addition, engineers are expected to consider the ethical and environmental consequences of their actions. In seeking internships and fulltime employment, employers will ask professors their opinion of not only your excellence in engineering, but also your ability to make engineering decisions that are safe, ethical and environmentally responsible. The practice of professionalism will be divided into the three areas of safety, attendance, and ethics.

Safety
Safety is of critical importance; it will be discussed numerous times throughout this course. Failure to follow safe laboratory practices can lead to accidents that can endanger you and other students. Your grade will be reduced if you fail to follow proper safety procedures.

Attendance Policy
Attendance is required. Attendance will count toward your final grade. An indirect grade of attendance will be given in all teamwork exercises. It is to your advantage to attend this class, since a substantial amount of material is presented for which no texts are available and many of the laboratories and in-class exercises will be conducted in teams. In addition to classes, you are expected to attend all scheduled team meetings.

Although arriving late for class can occur, a habitual practice of this is not professional. You will only be given credit for attendance in class if you are present within 5 minutes of the start of the start of the class period. If you know that you will be absent from class for a valid reason, obtain approval from your instructor 24 hours before the class period. The only exception to this rule is a medical emergency.

Academic and Work Conduct
Your ability to work effectively with your coworkers (classmates) and team leaders and managers is important for your success as an engineer. If you contribute creatively and effectively to the workload of your team in homework and laboratory assignments, and studying for quizzes and the final exam, then industry will actively seek you as an employee. If you are careless in your work, no company will want to hire you.

The policy in this class in matters of academic misconduct will follow that stated in "Rowan University Student Handbook." **While consultation between students on homework and laboratory assignments is encouraged, plagiarism is not. Any student cheating in this class will receive a grade of F for the course.** If another student is involved in the offense knowingly, he or she will receive the same penalty.

As an engineering professional, it is extremely important that you treat your manager and your colleagues with respect and consideration. It is expected, therefore, that you will maintain good professional conduct throughout this course, in all your interactions with your peers and the instructor. You will earn points for having good professional conduct, and you may lose points for exhibiting poor behavior.

COURSE OUTLINE
WATER RESOURCES ENGINEERING

PART I: Review of Fluid Mechanics

- Hydrostatics
- Conservation of Mass (Continuity)
- Conservation of Momentum
- Conservation of Energy; Bernoulli principle

PART II: Pipe Flow

- Headloss in pipes
- Pipe networks
- Turbomachinery
- Water distribution systems

PART III: Open-Channel Flow

- Water surface profiles
- Flow measurements

PART IV: Hydrology

- Probability & statistics
- Rainfall / runoff
- Storm drainage
- Ground water hydrology

LABORATORY INVESTIGATIONS

Lab 1: Flow in pipes
Lab 2: Transition energy losses
Lab 3: Flow measurements with weirs, flow meters
Lab 4: Turbine Contest
Lab 5: Open channel flow measurements

DESIGN PROJECTS

Project 1: Penstock design, engineering economics
Project 2: Pipe junctions / reservoirs
Project 3: Water distribution systems
Project 4: Water surface profiles
Project 5: Hydrology

Water Resources Engineering - Tentative Schedule

Date	Day	Topics	Reading	Labs / Projects
Jan 19	W	**I. Introduction, Review**	**Chapters 1-3**	*Reynolds experiment demo*
Jan 21	F	**II. Pipe flow**	**Chapter 4**	Lab 1: Pipe flow
Jan 24	M	*Moody diagram*		
Jan 26	W	*"Minor" losses*		
Jan 28	F			Project 1: Penstock sizing
Jan 31	M	*Equivalent lengths*		
Feb 2	W	*Pipes in Series*		
Feb 4	F			Lab 2: Transition Losses
Feb 7	M	*Pipes in Parallel*		
Feb 9	W	*Non-circular pipes*		
Feb 11	F			Lab 3: Flow Measurements
Feb 14	M	*System H-Q curves*		
Feb 16	W	*No Class*		
Feb 18	F			Project 2: Pipe junctions
Feb 21	M	*Finite differences*		
Feb 23	W	*MS Solver*		
Feb 25	F			Lab 4: Turbine Contest
Feb 28	M	*Turbomachinery*		
Mar 2	W	*Pumps & turbines*		
Mar 4	F			Project 3: Water distribution systems
Mar 7	M	*Pump curves*		*Series/parallel pump demo*
Mar 9	W	*Water distribution*		
Mar 11	F			**Midterm Exam**
Mar 14	M	**Spring Break**		
Mar 16	W			
Mar 18	F			
Mar 21	M	**III. Open Channel Flow**	**Chapter 5**	
Mar 23	W	*Manning equation*		
Mar 25	F	*No Class - Holiday*		
Mar 28	M	*Limiting Cases*		
Mar 30	W	*Types of Controls*		
Apr 1	F			Lab 5: Open Channel Flow
Apr 4	M	*Hydraulic Jump*		
Apr 6	W	*Specific Energy*		
Apr 8	F			*Project 4: Water surface profiles*
Apr 11	M	**IV. Hydrology**	**Chapter 7**	
Apr 13	W	*Probability / Statistics*		
Apr 15	F			
Apr 18	M	*Surface Hydrology*	**Chapter 8**	
Apr 20	W	*Rational Method*		
Apr 22	F			Project 5: Drainage
Apr 25	M	*Soils, land use*		
Apr 27	W	*No Class*		
Apr 29	F	*Advanced methods*		
May 2	M	**Review**		
May 4	W	**FINAL EXAM**	12:30 – 2:30 pm	