

Environmental Fluid Mechanics
908-445 / 908-545

Fall 2004

4:45 - 6:00 pm Tuesday & Thursday

The fundamental theme of the course is the engineering study of fluid flow in the environment. Advanced topics in water resources engineering are explored, with content varying based upon instructor and student interests. Past topics have included open channel flow, hydrology, fish passage at hydraulic structures, sediment transport, mixing in natural water bodies, and water quality modeling. The course includes appropriate laboratory and/or field experiments and computer applications. The course audience is primarily 4th year engineering and graduate students with knowledge of fluid mechanics, environmental engineering, chemistry, and water resources engineering.

INSTRUCTOR: Dr. Joe Orlins, 234 Rowan Hall, (856) 256-5328
Email: orlins@rowan.edu

TEXT: *No textbook required*

Supplement: *Water Resources Engineering*, by Chin

Supplement: *Chemical Fate and Transport in the Environment*, by Hemond & Fechner

Supplement: *Fluid Mechanics*, by Crowe, Roberson & Elger

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

WEB PAGE: <http://engineering.rowan.edu/~orlins/efm/>

GRADING:	Professional Conduct	50 points	(5%)
	Homework	250 points	(25%)
	Design Projects	250 points	(25%)
	Field Research Project	250 points	(25%)
	Final Exam	300 points	(30%)
	TOTAL	1000 points	

Explanation of Grading System:

Homework (25%): 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.

Design Projects (25%): 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.

Field Research Project (25%): You will work with a partner to monitor water quality parameters at a field site near the University campus. Measurements must be made weekly, with detailed records kept. You will observe and (and note) temporal trends in water quality, and will discuss these with the class. You will make a presentation (and provide a written report) at the end of the semester

Final Exam (30%): The final exam will allow you to integrate and synthesize the material covered in this class. It will be cumulative. It will be an individual exam.

Graduate Credit: To receive graduate credit for this course, one or more additional design projects or a research report must be completed, along with a presentation to the class.

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.

TENTATIVE LIST OF TOPICS

The content of this course is dictated partly by student interests. Some potential topics include:

Chemical Fate and Transport in the Environment

- Advection-diffusion (*the* "Mass Transfer" equation)

- Quantifying water quality in natural systems

- Limnology (the study of lakes)

- Mixing in rivers (dilution, dispersion, and turbulent diffusion)

- Existing data sources

Dissolved Oxygen

- Interfacial mass transfer

- Streeter-Phelps Equation

Principles of sediment transport:

- Bed load, suspended load, and wash load

- Erosion and deposition

- River meandering

Water quality modeling:

- Types of models available

- Application of models

- Input requirements

- Analysis of results

Environmental / Water Quality Regulations

- TMDLs

- Role of government agencies

 - NJDEP

 - US EPA

 - USGS

 - County-level

If we proceed with these topics, then by the end of the semester you will be able to:

1. Derive and understand the advection-diffusion equation
2. Apply the mass transfer equation to water quality in environmental systems
3. Measure environmental parameters in natural systems
4. Understand and explain temporal trends in environmental systems
5. Find, analyze, and interpret existing environmental quality information
6. Understand and apply principles of limnology
7. Understand and explain mixing in rivers
8. Estimate mass transfer coefficients
9. Calculate the dissolved-oxygen sag curve in rivers
10. Understand and explain the principles of sediment transport
11. Use a water quality model, and understand program input and output
12. Understand and explain current environmental regulations in New Jersey related to water quality

Of course, if we (as a class) decide to alter the list of topics, the learning outcomes objectives will be revised, accordingly.

Environmental Fluid Mechanics Tentative Course Schedule

Date	Day	Topics	Suggested Reading	Labs / Projects
9/2	Th	Introduction	H&F, pp 67-92 Chin, Chap 8	Pick partner Pick monitoring site
9/7	Tu	Fate and Transport		
9/9	Th			
9/14	Tu	Mass Transfer Eqn		
9/16	Th			
9/21	Tu	Limnology		
9/23	Th			
9/28	Tu	Mixing in Rivers		
9/30	Th	Existing data sources		
10/5	Tu	Dissolved Oxygen		
10/7	Th			
10/12	Tu	Interfacial Mass Xfer		
10/14	Th			
10/19	Tu	Streeter-Phelps		
10/21	Th			
10/26	Tu	Sediment Transport		
10/28	Th			
11/2	Tu	WQ Modeling		
11/4	Th			
11/9	Tu	Model application		
11/11	Th	Veteran's Day		NO CLASS
11/16	Tu			
11/18	Th	Analysis of Results		
11/23	Tu			
11/25	Th	Thanksgiving		NO CLASS
11/30	Tu	Environmental Regs		
12/2	Th	Gov't agencies		
12/7	Tu	Presentations		
12/9	Th	Presentations		
12/16	Th	FINAL EXAM	2:45 – 4:45 pm	