



Department of

Environmental Engineering

Mercer University

Syllabus for EVE 405.001
Design and Analysis of Wastewater Systems
Spring Semester 2008
TR 9:25 pm to 10:40 am
Room EGC 110

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Textbooks and Supplies:

Required: ***Unit Operations and Processes in Environmental Engineering***, T. D. Reynolds and P. A. Richards, PWS, 1996.

Reference: ***Water Supply and Pollution Control***, W. Viessman and M. J. Hammer, 7th Edition, Harper Collins, 2004.

Catalog Description: Analysis and design of wastewater treatment systems beginning with an overview of the sources of water pollution and discussion of wastewater characteristics. Fundamental theory and design of conventional wastewater treatment facilities is presented followed by the principles used to design advanced wastewater treatment facilities.

Course Learning Objectives: Upon successful completion of this course, you should be able to do the following:

1. Students will be able to identify, analyze, and select the appropriate physical, chemical, and biological parameters used for assessing water quality and used in the design and operation of wastewater treatment facilities (Outcome #2).
2. Students will be able to analyze, select, and design conventional unit operations and processes used in treating wastewater to a specified level (Outcomes #1, #2, and #3).
3. Students will be able to analyze, select, and design advanced unit operations and processes used in treating wastewater to a specified level (Outcomes #1, #2, and #3).
4. Students will improve their written communication and design skills by preparing a preliminary design report detailing the design of a wastewater treatment plant (Outcomes #2, #3 and #6).

Prerequisites: EVE 290 and EVE 384.

Course Content (Tentative):

| Date | Subject | Reading Assignment | Problems |
|-------|---|---------------------|------------------------------------|
| 1/8 | Chemical Kinetics & Biological Concepts | 1-16, 19-35 | 1.1, 1.4, 1.8, 1.9, 1.10, 2.2, 2.3 |
| 1/10 | Mass Balances & Flow Models | 38-47 | 3.1, 3.3 |
| 1/15 | Mass Balances & Flow Models | 47-63 | 3.4, 3.7 |
| 1/17 | Wastewater Sources & Flows | 93-102 | 5.1, 5.2 |
| 1/22 | Wastewater Characteristics | 102-111 | 5.3 |
| 1/24 | Wastewater Characteristics | 102-111 | 5.4 |
| 1/29 | Overview of Wastewater Treatment | 114-127 | |
| 1/31 | Preliminary Treatment TM-1 DUE | 134-156 | 7.1, 7.3 |
| 2/5 | Preliminary Treatment | 156-162 | 7.5, 7.10 |
| 2/7 | Test #1 | | |
| 2/12 | Sedimentation | 219-247 | 9.2, 9.3 |
| 2/14 | Sedimentation | 247-255 and 257-275 | 9.15, 9.18, 9.24 |
| 2/19 | Activated Sludge | 411-427 | 15.2 |
| 2/21 | Activated Sludge | 427-440 | 15.4 |
| 2/26 | Activated Sludge | 440-459 | 15.35 |
| 2/28 | Activated Sludge TM-2 DUE | 459-487 | 15.37, 15.47 |
| 3/3-7 | Spring Break | | |
| 3/11 | Oxygen Transfer | 498-509 | 16.4, 16.5, 16.19 |
| 3/13 | Oxygen Transfer | 509-518 | 16.13, 16.26 |
| 3/18 | Test #2 | | |
| 3/20 | Attached Growth | 523-544 | 17.9, 17.19 |
| 3/25 | Attached Growth | 544-552 | 17.21 |
| 3/27 | Disinfection TM-3 DUE | 740-754 | |
| 4/1 | Advanced Treatment | Handout | 11.5 |
| 4/3 | Advanced Treatment | Handout | |
| 4/8 | Solids Handling | 629-658 | 21.2, 21.8, 21.17 |
| 4/10 | Anaerobic Digestion | 573-587 | 19.2 |
| 4/15 | Anaerobic Digestion | 587-604 | 19.16 |
| 4/17 | Aerobic Digestion TM-4 DUE | 610-624 | 20.2, 20.5 |
| 4/22 | Test #3 | | |
| 4/24 | BIOWIN TM-5 DUE | Handout | |
| 5/3 | COMPREHENSIVE FINAL EXAM | 7 to 10 pm | |

Course Expectations:

- Attendance.** Class attendance is mandatory and students should be on time. Students missing classes are responsible for material covered in the lectures and for any announced changes to the schedule. **Each unexcused absence will result in a final grade penalty of 1 point per absence. This means that 1 point per absence will be subtracted from your overall final grade.** If you are more than 10 minutes late to a lecture, please do not enter the classroom. Students missing examinations will receive a 'zero' grade except under very special circumstances (hospitalization, member of armed forces involved in mobilization, etc). Athletes who miss class due to scheduled events in which they are officially participating are expected to make arrangements in advance of their absence.
- Homework problems are noted on the course syllabus.** You cannot “make up” experiential learning and to perform well in the course, it is essential that you completely work homework problems. Problems will not be collected for grade. It is highly recommended that you work all problems listed on the syllabus to achieve your maximum potential in this course.

3. **Work for Grade:** Anything that you turn in for grade should reflect professionalism and something that you would be proud of turning in to your boss at work. **Late assignments will receive a grade of zero.**
 4. **Design Project:** Each student will prepare a preliminary design of a wastewater treatment plant. Technical memorandums will be written for each major group of unit operations and processes. The first memo will be entitled "Basis for Design". This memorandum will present and discuss the design flows, design loadings, influent wastewater characteristics, effluent wastewater characteristics, and show a schematic of the proposed treatment process. A brief description of the each unit operation and process should be presented. The final preliminary design project will be due on **April 24, 2008** at the beginning of class.
 5. **Tests: Three CLOSED BOOK and CLOSED NOTES** tests will be administered during the semester. An equation sheet with the major equations associated with design will be provided for each test. Approximately 85 to 90 % of the test problems will be based on the lecture, readings from text, and the instructor's notes. Approximately, 10 to 15 % of the problems will require students to synthesize and apply information presented in class to new problems. ABET 2000 requires professors assess student performance.
 6. **Exam:** The final exam is comprehensive and will be **CLOSED BOOK and CLOSED NOTES**. The format may be a combination of multiple choice, discussion, problems, acronyms, and definition of terms. Approximately 85 to 90 % of the problems will be based on lectures, readings, and instructor's notes. Approximately, 10 to 15 % of the problems will contain questions that require students to synthesize and apply information to new situations. The final exam is the major means of assessing student performance in the course. ABET 2000 requires professors assess student performance.
 7. **Class preparation:**
 - a) Read and study materials in *Unit Operations and Processes in Environmental Engineering* or seek out other texts and resources in Tarver Library such as *Water Supply and Pollution Control*, W. Viessman and M. J. Hammer and *Wastewater Engineering Treatment and Reuse*, Metcalf and Eddy.
 - b) Work the assigned homework problems and seek help from the instructor when you don't understand. Don't wait until it's too late to get help!
 8. **Grading** encompasses every aspect of the course, from participation through final products. You can assume that every task requested directly or indirectly factors into your grade. Regular feedback will be given on documents handed in. The final grade will be determined as follows: **Project: 30%, 3-Tests: 40% Final Exam: 30%**
- Each student's final letter grade will be based on the following scale: **A = ≥ 90 ; B+ = ≥ 85 but < 90 ; B = ≥ 80 but < 85 ; C+ = ≥ 75 but < 80 ; C = ≥ 70 but < 75 ; D = ≥ 60 but < 70 ; and F = < 60 .**
9. You are encouraged to schedule a **conference** at any point that you need it. If you need to see me, catch me after class to schedule a time or call the MAE/BME/EVE Secretary (Ms. Denise Malone), at 301-2430 to get on my calendar.
 10. Out of courtesy for all those participating in the learning experience, all cell phones and pagers must be turned off before entering any class, lab, or formal academic or performance event.
 11. The **honor code** provisions as outlined in the *Bulletin* and in the student handbook, *The Lair*, will be assumed for everyone. It should be clear from class discussion, which projects will be collaborative and which ones must be individual. When in doubt, please ask to avoid

potentially embarrassing situations. Plagiarism is a violation of the honor code and is prohibited.

12. The best way to reach me is through e-mail. I will check my e-mail once each day and generally this will be in the mornings.
13. This syllabus is subject to change.

Electronic Communication:

Electronic communication is an important adjunct to face-to-face communication, including from professor to students, students to professor, and students to students. You must have regular access to your e-mail and to the course website. If you do not have an active e-mail address on the first day of class, please secure one. Access to the Web and to the Internet is also integral to the class work. A number of laboratories on campus will provide access, in addition to EGC 102 and EGC 111-B.

Important Additional Information:

“Students with a documented disability should inform the instructor at the close of the first class meeting or as soon as possible. If you are not registered with Disability Services, the instructor will refer you to the Student Support Services office for consultation regarding documentation of your disability and eligibility for accommodation under the ADA/504. In order to receive accommodations, eligible students must provide each instructor with a “Faculty Accommodation Form” from Disability Services. Students must return the completed and signed form to the Disability Services Coordinator on the 3rd floor of the Connell Student Center. Students with a documented disability who do not wish to use academic accommodations are strongly encouraged to register with Disability Services and complete a Faculty Accommodation Form each semester, also. For further information, please contact Carole Burrowbridge, Disability Services Coordinator, at 301-2778 or visit the website at http://www.mercer.edu/stu_support/swd.htm.”

From the ASCE Code of Ethics

Engineers uphold and advance the integrity, honor, and dignity of the engineering profession by:

1. Using their knowledge and skill for the enhancement of human welfare and the environment;
2. Being honest and impartial and serving with fidelity the public, their employers and clients;
3. Striving to increase the competence and prestige of the engineering profession; and;
4. Supporting the professional and technical societies of their disciplines.

CANON 1. Engineers shall hold paramount the safety, health and welfare of the public and shall strive to comply with the principles of sustainable development in the performance of their professional duties.

Program Outcomes: Students at the time of graduation will know and be able to do the following:

1. Apply mathematics and science principles to the solution of engineering problems.
2. Apply appropriate breadth and depth of skills in identification of engineering problems designed with realistic constraints.
3. Apply appropriate breadth and depth of skills in engineering design and analysis of engineering problems designed with realistic constraints.
4. Design and conduct experiments and analyze data.
5. Function on interdisciplinary teams.
6. Communicate to both specialized and public audiences in a variety of modes, i.e., writing, presentation, etc.
7. Relate the practice of engineering to global contemporary issues, to professional ethics, and to the need for lifelong learning.
8. Contribute to sustaining and improving community.