Florida International University
Department of Civil and Environmental Engineering

Course Syllabus
ENV 3001: Introduction to Environmental Engineering (3 credits)
Spring Semester 2021: January 11, 2021 – April 24, 2021

Overview:

The role of the environmental engineer is to protect public health and safety from the adverse effects of pollution and to ensure that nature's ecosystems are not adversely affected as they are used to benefit man. This course introduces students to environmental problems and their resolution including water and wastewater treatment, air pollution and control, and solid and hazardous waste management. A significant portion of the course is devoted to a review of general and physical chemistry, as well as a quick review of first-order linear differential equations (LDE). The associated laboratory class ENV 3001L illustrates several analytical techniques commonly used in the analysis of environmental samples, and demonstrates the mechanisms involved in some of the treatment processes. The ENV 3001 course also discusses differences in population growth and demography, resource consumption, and the resulting environmental impacts between different regions of the world. This is a discipline-specific Global Learning (GL) course that counts towards your FIU Global Learning graduation requirement.

Catalog Course Description:

Introduction to environmental engineering problems; water and wastewater treatment, air pollution, ~~noise~~, solid and hazardous wastes.

Prerequisites:

CHM 1045/6 and CHM 1045/6L, and MAC 2312 or MAC 2282.

Corequisite:

ENV 3001L Environmental Laboratory

Instructor:

Dr. Shonali Laha, P.E.

Email: lahas@fiu.edu
Office hours: Mondays and Wednesdays 10:45 – 12:00, and by appointment. (via Zoom)
URL: http://faculty.fiu.edu/~lahas/

Location and Timing:

Room: N/A via Zoom
Mondays and Wednesdays 9:30 – 10:45

Final Examination:

Week of April 19 – 24, 2021

Textbook:

Gilbert Masters and Wendall Ela, *Introduction to Environmental Engineering and Science,* Third Edition, Prentice-Hall, Inc., 2007 (ISBN: 13:978-0-13-148193-0)

Students, faculty and staff get a digital subscription to The New York Times for free. This is a valuable benefit provided by Florida International University. The URL link is below.
www.nytimes.com/FIU

Excellent Science (and other) Reading:

Jill Lepore, *These Truths: A History of the United States,* W.W. Norton & Company, Inc., 2018.
Bill Bryson, *A Short History of Nearly Everything,* Broadway Books, 2003.
Alan Weisman, *The World Without Us*, St Martin's Press, 2007.
Elizabeth Kolbert, *The Sixth Extinction*, Henry Holt and Company, 2014.

And with the Black Lives Matter so much in the news, I strongly recommend the following documentary directed by Ava DuVernay to help us better understand the BLM movement.
https://www.youtube.com/watch?v=krfcq5pF8u8

Useful Reference Books:

Howard, A.G., *Aquatic Environmental Chemistry*, Oxford University Press, 1998 (ISBN: 0-19-850283-4)
This inexpensive little text is particularly helpful in clarifying concepts in environmental chemistry and in highlighting the relevance of chemistry to environmental engineers; also helpful for laboratory class ENV 3001L.

Davis and Cornwell, *Introduction to Environmental Engineering,* McGraw-Hill, Inc., 1991
Super text for FE and PE preparation for environmental engineering (any edition!)

Sawyer and McCarty, *Chemistry for Environmental Engineers*, Third Edition, McGraw-Hill, Inc., 1978

Benefield, Judkins, and Weand, *Process Chemistry for Water and Wastewater Treatment,* Prentice-Hall, Inc., 1982

Tchobanoglous and Schroeder, *Water Quality,* Addison-Wesley Publishing Company, 1985

Global Learning Outcomes:

1. Global Awareness: Students will demonstrate an understanding of the interrelatedness of environmental problems around the world, that these problems have no national borders, and that the extent of these problems is affected by the different socioeconomic, technological, and other conditions.
2. Global Perspective: Students will be able to conduct an analysis of the global nature of a selected environmental problem and the extent to which factors such as economics, technology, and society contribute to the problem.
3. Global Engagement: Students will demonstrate a willingness to develop an engineering solution, process, or technology that reduces adverse environmental impact, is more sustainable, and is appropriate within the framework of economic, technological, and societal factors at national, regional, and global levels.

Exit Competencies:

After successful completion of this course students should be able to:

1. Articulate the role of the environmental engineer in protecting public health and safety, and in restoring/preserving natural resources
2. Understand the relevance of concepts in general and physical chemistry in determining the quality and treatment options for water supplies, wastewater, and air pollution
3. Apply mass balance, chemical kinetics, and other empirical and semi-empirical concepts and techniques in developing basic treatment schemes.
4. Gain familiarity with both the traditional and the less common environmental contaminants
5. Identify unit operations/processes likely to be successful at eliminating these contaminants.

Grading Criteria:

The final grade will be based on the following criteria totaling 100 points:

Midterm Exams	30
Final Exam	15
Homework	10
Quizzes (best nine)	45

General Observations/Policies:

Please note that the attached schedule is tentative, serves only as a guideline, and is liable to change. You do not need to worry about occasional absences from class because I will allow quizzes to be dropped, i.e., plan to get in eleven quizzes through the semester and I will select the best nine for *each* student. The introductory environmental class is very wide in scope and although I believe that much of the information is intuitive and self-explanatory, you need to be sure to understand the concepts! And despite the environmental laboratory class (ENV 3001L) being taught by another professor, Dr. Bricker, the material covered in the lab will emphasize much of the chemistry in the theoretical sessions. Again, make sure you understand materials and clear any conceptual doubts, and I am sure that you will clear both ENV 3001 and ENV 3001L with flying colors! Your quiz performance will also help you to keep abreast with course materials.

A note about professional registration: engineering is a profession and typically we want to become licensed engineers with a P.E. designation. Toward that goal, all undergraduates are encouraged to take the first step toward licensure while still in school – passing the FE exam. Check the NCEES (http://ncees.org/) and FBPE (https://fbpe.org/) websites for information. Furthermore, since I hope many of the ENV 3001 students are sophomores, I want you to be aware of the 3+2 program at FIU's CEC that allows you to obtain both an MS and BS degree in five years. Typically an MS degree requires an additional 30 credits; however, the 3+2 program double counts 9 credits toward both the BS and MS degrees, and requires only 21 additional credits beyond the BS to secure the MS degree. Please check with the Undergraduate Advisor if you're eligible for the 3+2 program.

Also review the "University Misconduct Statement" attached below.

University Misconduct Statement

Florida International University is a community dedicated to generating and imparting knowledge through excellence in teaching and research, the rigorous and respectful exchange of ideas, and community service. All students should respect the right of others to have an equitable opportunity to learn and honestly demonstrate the quality of their learning. Therefore, all students are expected to adhere to a standard of academic conduct, which demonstrates respect for themselves, their fellow students, and the educational mission of the University. All students are deemed by the University to understand that if they are found responsible for academic misconduct, they will be subject to the Academic Misconduct procedures and sanctions, as outlined in the Student Handbook.

Misconduct includes: Cheating – The unauthorized use of books, notes, aids, electronic sources; or assistance from another person with respect to examinations, course assignments, field service reports, class recitations; or the unauthorized possession of examination papers or course materials, whether originally authorized or not. Plagiarism – The use and appropriation of another's work without any indication of the source and the representation of such work as the student's own. Any student who fails to give credit for ideas, expressions or materials taken from another source, including internet sources, is responsible for plagiarism.

Tentative Class Schedule:

Date	Lec	Topic	Chapter
1/11	1	Course introduction (HW-I, due 1/25). Read the article on solid waste generation, watch the TED lectures and movie *Home.*)	
1/13	2	Mass and energy transfer concepts. Spreadsheet usage, library resources. (HW-2: due 1/20)	1
1/18		Martin Luther King Day – no class. Work on HW-I	
1/20	3	**Quiz 1.** Mass and energy transfer problem solving/HW-2 discussion.	1
1/25	4	**Quiz 2.** More mass and energy balance concepts.	1
1/27	5	Discuss TED lectures, solid waste generation, and movie *Home.*	
2/1	6	**Quiz 3.** (on HW-2). Wrap up mass and energy balance.	1
2/3	7	Start chemistry review (HW-3: due 2/10)	2
2/8	8	Complete chemistry review. HW-3 solution discussion.	2
2/10	9	**Quiz 4.** (on HW-3). Problem solving in chemistry	2
2/15	10	**Quiz 5.** (on HW-3). Acid-base reactions and alkalinity.	2, 5
2/17	11	TH, Alk, BOD, acid-base titration and pH buffering	2, 5
2/22	12	Review mass balance and chemistry; solutions for HW-2 and HW-3	2, 5
2/24	13	**First Midterm Exam (Chapters 1 & 2)**	1, 2
3/1	14	Chapter 5: Water quality parameters – biodegradable organics = BOD; BOD exerted versus remaining. (HW-4: due 3/10)	5
3/3	15	**Quiz 6.** Wrap up BOD; PFR versus CSTR	5
3/8	16	**Quiz 7.** DO sag curve (river modeled as PFR)	5
3/10	17	Groundwater and Darcy's Law. Chapter 5 example problems; HW-4 discussion	5
3/15	18	**Quiz 8.** Municipal water and wastewater treatment. (HW-5: due 3/24)	6
3/17	19	Municipal water and wastewater treatment.	6
3/22	20	**Quiz 9**. Municipal water and wastewater treatment.	6
3/24	21	Examples, HW-5 discussion. Will also assign required HW-II	
3/29	22	Review exam on Chapters 5 & 6, HW-4 & 5	6
3/31	23	**Second Midterm Exam (Chapters 5 & 6)**	
4/5	24	Air pollution – mass balance over air shed. (HW-6: due 4/7)	7

4/7	25	**Quiz 10.** Air pollution
4/12	26	Summary of Chapter 3: Kinetics of growth and Chapter 4: Risk assessment
4/14	28	Final review class

ABET-related Objectives & Outcomes

The program objectives and outcomes that are directly supported by this course are:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Typical ENV 1001 Grading Scheme

Grade allocation	
Midterms	30
Final Exam	15
Homework	10
Quizzes (best seven of nine)	45

Grade Cutoffs (these may change a little):

>95	A
>90	A-
>85	B+
>80	B
>75	B-
>70	C+
>65	C
<65	D/F

Conversions you will need to be familiar with:

Although the entire world including Great Britain (a.k.a. the U.K.) has moved on to adopt the SI system of measurement (based on meters for length, kg for mass, °C for temperature, Joules or kJ for energy, etc.), engineers in the U.S. continue to be enamored of the old British units of measurement.

Through this and other courses you will need to be familiar with both sets of measurements.

- Appendix A of your textbook lists useful conversion factors.
- The Formula Sheet for ENV 3001 that I have uploaded onto Blackboard and attached with the syllabus – also lists some useful conversions.
- Table F.1 Formulas for Unit Conversions from the fluids textbook also posted on Blackboard

Furthermore, be aware of really common conversions. For example,

1. Flow capacities for drinking water and wastewater treatment plants are generally listed in million gallons per day or MGD, e.g., the Preston Water Treatment in Hialeah has a capacity of 160 MGD. What does this correspond to cubic meters per second or m^3/s? (Given 1 MGD = 0.0438125 m^3/s, the Preston Water Treatment Plant capacity is approximately 7 m^3/s)
2. The winter temperatures in much of the northern U.S. can reach –27 °C. What does that translate to in degrees Fahrenheit? And what does the balmy 80 °F enjoyed by southern Florida amount to in Celsius? (Given conversion formula C = (F – 32) × 5/9; the northern temperatures are –17°F, and Miami's 80 °F corresponds to about 27 °C.)
3. Fuel heating values refer to the amount of energy released when burning a fuel. You will find units of Btu/lb (or Btu/gal) commonly used in the U.S. For example, methane has a heating value (HV) of approximately 1000 Btu/ft^3, gasoline has a HV of 125,000 Btu/gal, coal has HV of 12,500 Btu/lb, and pelletized rubber has HV of 16,000 Btu/lb. However, when you use thermodynamic data to compute the heat of combustion for methane in Examples 2.4 and 2.5 of your text, you report the HV as kJ/mol. How would you convert between one and the other?!