CE 5321: Engineering for Environmental Scientists
Fall 2017

Instructor : Srinivas Prabakar, Ph.D.
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Office Hours : Tuesday 8:30 am – 10:30 am and Wednesday 10:00 am to 12:00 pm;
Other than office hours you can meet me by making an appointment.
Section Information : **CE 5321-001/101**
Time and Place of Class Meetings: TR 11:00 am – 12:20 pm, NH 109

Description of Course Content: Fundamental principles of engineering science applicable to the comprehension and design of engineered environmental systems. Includes water and air quality indices; kinetic and reactor theory; mass and energy balances; fluid system theory; and applications of physical, chemical and biological processes in the design of engineered environmental systems. May not be used to satisfy any of the requirements for a graduate degree in Civil Engineering. Prerequisite: PHYS 1441, CHEM 1442, and MATH 2425.

Student Learning Outcomes: The course material will include lectures on the use of fundamental mathematics, engineering and chemistry principles to solve environmental engineering problems related to water, wastewater, air quality and solid waste; design components of systems/processes for treating water and wastewater; and to demonstrate an understanding of key pieces of environmental legislation. The student abilities and outcomes from this course are

- Ability to apply knowledge of mathematics, science, and engineering
- Ability to analyze and interpret data
- Ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

Required Textbooks and Other Course Materials: Principles of Environmental Engineering and Science, 3rd edition, Mackenzie Davis & Susan Masten, McGraw-Hill, 2013, ISBN 978-0-07-339790-0.

Descriptions of major assignments and examinations:

Homework: Homework will be assigned every week and it is due one week after it is assigned (usually on Thursday). Late homework will not be accepted without the consent of the instructor. Homework must be done using the typical engineering format of Given, Find, and Solution. Your solutions must be presented linearly down the page so a reviewer can easily follow your solution. Every reasonable step in your solution must be presented.

Exams: There will be two midterm exams and one final exam. Students who miss the exam without a written medical excuse or an excuse approved by the instructor will receive a grade of zero for the exam. Students presenting proper documentation of an excused absence will have to schedule the makeup test within 3 days of the return. No makeup exam for the final.

Term paper: Please see the guidelines for term paper in the blackboard.

Attendance: At The University of Texas at Arlington, taking attendance is not required but attendance is a critical indicator in student success. Each faculty member is free to develop his or her own methods of evaluating students' academic performance, which includes establishing

course-specific policies on attendance. As the instructor of this section, Class attendance is required. In the event of an absence, it is the student's responsibility to obtain class notes, assignments, etc. However, while UT Arlington does not require instructors to take attendance in their courses, the U.S. Department of Education requires that the University have a mechanism in place to mark when Federal Student Aid recipients "begin attendance in a course." UT Arlington instructors will report when students begin attendance in a course as part of the final grading process. Specifically, when assigning a student a grade of F, faculty report the last date a student attended their class based on evidence such as a test, participation in a class project or presentation, or an engagement online via Blackboard. This date is reported to the Department of Education for federal financial aid recipients.

Grading: I reserve the right to vary from the grade schedule listed below.

Homework	10%
Term paper	15%
Exam 1	25%
Exam 2	25 %
Final Exam	25%
Plant visit (Extra)	2% each

Grade Basis:	90 – 100 %	A
	80 - 89.9 %	B
	70 - 79.9 %	C
	60 - 69.9 %	D
	Below 60 %	F

Students are expected to keep track of their performance throughout the semester and seek guidance from available sources (including the instructor) if their performance drops below satisfactory levels.

Make-up Exam Policy: No make-up exams are given except for medical or other similar hardships where advanced arrangements are made with the instructor; or in case of non-selective medical emergencies with appropriate physician's note or documentation. Other than circumstances described above, failure to take the exam at the scheduled time will constitute a grade of zero in the exam.

Grade Grievance Policy: Grade grievances will be handled according to the policy described in the College of Engineering portion of the Catalog.

Drop Policy: Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. **Students will not be automatically dropped for non-attendance**. Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (http://wweb.uta.edu/aao/fao/).

Disability Accommodations: UT Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including *The Americans with Disabilities Act (ADA), The Americans with Disabilities Amendments Act (ADAAA),* and *Section 504 of the Rehabilitation Act.* All instructors at UT Arlington are required by law to provide "reasonable

accommodations" to students with disabilities, so as not to discriminate on the basis of disability. Students are responsible for providing the instructor with official notification in the form of **a letter certified** by the Office for Students with Disabilities (OSD). Only those students who have officially documented a need for an accommodation will have their request honored. Students experiencing a range of conditions (Physical, Learning, Chronic Health, Mental Health, and Sensory) that may cause diminished academic performance or other barriers to learning may seek services and/or accommodations by contacting: **The Office for Students with Disabilities, (OSD)** www.uta.edu/disability or calling 817-272-3364. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at www.uta.edu/disability.

Counseling and Psychological Services (CAPS) www.uta.edu/caps/ or calling 817-272-3671 is also available to all students to help increase their understanding of personal issues, address mental and behavioral health problems and make positive changes in their lives.

Non-Discrimination Policy: *The University of Texas at Arlington does not discriminate on the basis of race, color, national origin, religion, age, gender, sexual orientation, disabilities, genetic information, and/or veteran status in its educational programs or activities it operates. For more information, visit uta.edu/eos.*

Title IX Policy: The University of Texas at Arlington ("University") is committed to maintaining a learning and working environment that is free from discrimination based on sex in accordance with Title IX of the Higher Education Amendments of 1972 (Title IX), which prohibits discrimination on the basis of sex in educational programs or activities; Title VII of the Civil Rights Act of 1964 (Title VII), which prohibits sex discrimination in employment; and the Campus Sexual Violence Elimination Act (SaVE Act). Sexual misconduct is a form of sex discrimination and will not be tolerated. *For information regarding Title IX, visit* www.uta.edu/titleIX or contact Ms. Jean Hood, Vice President and Title IX Coordinator at (817) 272-7091 or jmhood@uta.edu.

Academic Integrity: Students enrolled all UT Arlington courses are expected to adhere to the UT Arlington Honor Code:

> *I pledge, on my honor, to uphold UT Arlington's tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.*
>
> *I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.*

UT Arlington faculty members may employ the Honor Code in their courses by having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System *Regents' Rule* 50101, §2.2, suspected violations of university's standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student's suspension or expulsion from the University. Additional information is available at https://www.uta.edu/conduct/.

Electronic Communication: UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge

to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at http://www.uta.edu/oit/cs/email/mavmail.php.

Campus Carry: Effective August 1, 2016, the Campus Carry law (Senate Bill 11) allows those licensed individuals to carry a concealed handgun in buildings on public university campuses, except in locations the University establishes as prohibited. Under the new law, openly carrying handguns is not allowed on college campuses. For more information, visit http://www.uta.edu/news/info/campus-carry/

Student Feedback Survey: At the end of each term, students enrolled in face-to-face and online classes categorized as "lecture," "seminar," or "laboratory" are directed to complete an online Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through MavMail approximately 10 days before the end of the term. Each student's feedback via the SFS database is aggregated with that of other students enrolled in the course. Students' anonymity will be protected to the extent that the law allows. UT Arlington's effort to solicit, gather, tabulate, and publish student feedback is required by state law and aggregate results are posted online. Data from SFS is also used for faculty and program evaluations. For more information, visit http://www.uta.edu/sfs.

Final Review Week: for semester-long courses**,** a period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week *unless specified in the class syllabus*. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. During this week, classes are held as scheduled. In addition, instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate.

Emergency Exit Procedures: Should we experience an emergency event that requires us to vacate the building, students should exit the room and move toward the nearest exit. When exiting the building during an emergency, one should never take an elevator but should use the stairwells. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist individuals with disabilities.

Student Support Services: UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include tutoring, major-based learning centers, developmental education, advising and mentoring, personal counseling, and federally funded programs. For individualized referrals, students may visit the reception desk at University College (Ransom Hall), call the Maverick Resource Hotline at 817-272-6107, send a message to resources@uta.edu, or view the information at http://www.uta.edu/universitycollege/resources/index.php.

Civil Engineering Librarian: Martin Wallace, Engineering Librarian. Mailing address: Central Library, Office Number: 518. Phone: 817-272-3924, Email: martin.wallace@uta.edu

Course Schedule

Date	Topics covered / Notes	Resource
Aug 24	**Course Policies: Introduction**- Environmental regulations, Roles of Environmental engineers and environmental scientist. Ecology.	Ch 1.1-1.8 Ch 5.1-5.4
Aug 29,31	**Environmental quality parameters and chemistry:** Concentrations, Solids, Turbidity, Nitrogen, Phosphorus.	Class Notes
Sep 5,7	**Organic chemistry** – Lipids, Nucleotides and Nucleic acid, protein carbohydrates. Microbes and Metabolic processes - Classification of microorganisms, Metabolism, Ideal gas law, Henry's Law.	Handouts
Sep 12, 14	Equilibrium constant expressions, ionization constants, Types of reaction, Oxidation- Reduction reactions.	Handouts
Sep 19, 21	Acid- base Equilibrium, Carbonate buffer system – closed system, Alkalinity, Acidity	Handouts
Sep 26, 28	Concentrations of chemical species in precipitation-dissolution reactions, Hardness, Scaling and corrosion, Reaction kinetics –rate and order of reaction.	Handouts
Oct 3, 5	**Materials and energy balances:** Material balance diagrams, Reactors. Mass balance problems with and without transformation, **Exam 1 on Oct 5.**	Chapter 4 Handouts
Oct 10, 12	Steady state, Conservative, Non-conservative. Step function response, Reactor alternatives based on volume, efficiency and retention/residence time.	
Oct 17, 19	DO, BOD – seeded and unseeded, rate constant.	Ch 9.3
Oct 24, 26	Difference between COD, ThOD, BOD, NOD, NBOD. Oxygen sag curve. Coliforms.	
Oct 31, Nov 2	**Water treatment:** Primary and secondary treatments - rapid mix and flocculation tanks, coagulation – consumption of alkalinity for a given dose of alum. Sediment basin – size and weir length, Filtration, disinfection- different types of disinfectant.	10-2,4,5,6
Nov 7, 9	**Wastewater treatment:** Process and principles - Pretreatment, primary treatment, secondary treatment, tertiary treatment and Disinfection. Efficiency of TSS and BOD removal. Evaluate or size primary (and secondary) sedimentation tanks with respect to detention time, overflow rate, solids loading and weir loading.	Ch 11.1-11.8
Nov 14, 16	Activated sludge treatment - qc and F/M ratio, Hydraulic detention time, soluble BOD_5, wasting flow rate**. Exam 2 on Nov 16. Nov 16 - Deadline for finalizing the term paper topic.**	
Nov 21	**Air pollution:** Threshold pollutants, non-threshold pollutants, Emission standards and air quality standards. Criteria pollutants - Causes, sources and effects, Terms associated with air quality and air quality standards. Air quality problems. Atmospheric dispersion, Air pollution control**.**	Ch 12
Nov 28, 30	**Solid Waste and Hazardous Materials Legislation:** Solid waste, Hazardous waste, Classification of wastes, terminology associated with solid and hazardous material legislation. **Review.**	Ch 13
Dec 5	**Review. Dec 5 – Deadline for term paper/plant visit report submissions**	
Dec 12	**Final exam 11:00 am – 1:30 pm**	

"As the instructor for this course, I reserve the right to adjust this schedule in any way that serves the educational needs of the students enrolled in this course. –Srinivas Prabakar."