

## CE 5344 – Biological Unit Operations/Processes – Spring 2023

The University of Texas at El Paso  
Civil Engineering  
Lecture: UGLC 340 MW 6:00-7:20 PM  
CRN: 27948  
Cross-listed:  
CE 4375 (25693)  
CE 4376 (25700)  
CE 4377 (25701)  
Prerequisites: CE 4342

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### NOTICE:

**Class meetings and exams will be IN-PERSON according to the schedule provided at the end of this syllabus.** Homework assignments will be administered asynchronously online, and communication will be sent by email through Blackboard (<https://my.utep.edu/>).

### PRECAUTIONS for the spread of communicable disease

Please stay home if you are sick. If you are feeling unwell, please let me know as soon as possible, so that we can work on accommodations (if possible).

### Philosophy

I believe that *teaching* and *learning* are interdependent; you cannot have one without the other. You and I are partners and colleagues, working together to help you grow as a knowledgeable, curious, intrinsically motivated, and confident engineer. I want to help you grow as a critical thinker with sharpened skills of analysis, evaluation, and synthesis. I incorporate team-based projects to help you prepare for professional practice and to help you develop as a more robust and intrinsically-motivated engineer. I have also realized that it is important to provide weekly homework assignments to help reinforce understanding and application of the main concepts. Thus, I have implemented a combination of homework assignments, online forum discussions, exams, and team projects in this course.

### Required Text: Metcalf & Eddy (2014) Wastewater Engineering: Treatment and Reuse, 5<sup>th</sup> Ed., McGraw Hill (Textbook Website: [www.mhhe.com/metcalf](http://www.mhhe.com/metcalf))

Supplemental Texts: Rittman & McCarty (2001) Environmental Biotechnology, McGraw Hill;

Davis (2020) Water and Wastewater Engineering, 2<sup>nd</sup> Ed., McGraw Hill;

Viessman et al (2009) Water Supply & Pollution Control, 8<sup>th</sup> Ed., Prentice Hall;

Droste (1997) Theory and Practice of Water and Wastewater Treatment, John Wiley & Sons;

### Description and Objectives

This course involves a study of theory and preliminary design of basic physical, chemical, and biological processes involved in municipal wastewater treatment systems. The objectives of this course are to develop:

1. design background required to solve problems dealing with water quality, wastewater treatment, water storage and water regulation.
2. design knowledge sufficient to pass the Environmental Engineering section of Fundamental Engineering (FE/EIT) exam and the Professional Engineering (PE) exam.
3. the ability to work in teams on complex design problems.
4. an awareness of the environment in which we, as a society, live and the significance of the local, state, national and global problems that face the engineering community.

## Topics Covered

The topics covered in this course are:

1. Wastewater Quality Parameters and Regulations
2. Biological Wastewater Treatment Processes
3. Wastewater Reclamation and Reuse
4. Sludge Processing

## Expectations

**Participation:** More than simply attending class, you are invited to *think*, and *participate* in the lectures and discussions. I encourage you to be curious and inquisitive during lectures and discussions.

**Punctuality:** Assignments submitted late will receive half credit.

**Ethics:** In engineering, personal integrity is of utmost importance, especially in the assessment and reporting of environmental conditions. Also, in most cases, it is necessary to work in teams to develop and design optimal solutions to problems and challenges, and it is essential that each team member contribute to the productivity of the team. In this course, I strongly recommend that you complete homework assignments in teams; in many cases, you will help each other through the solution of difficult problems. My goal for the homework is for you to develop proficiency in the basic application and calculations in design. Thus, every student is accountable for *understanding* the concepts, analysis, and solution. My goal for the projects is for you to have opportunity to apply this theory in a deeper and more meaningful way than homework. Each student is accountable for understanding and *contributing* (equitably) to the team projects. Any student committing plagiarism (*e.g.*, copying another's work without understanding) or any other form of academic dishonesty will be reported to the Dean of Students for disciplinary action (which may include expulsion from the University). For a concise summary of engineering ethics, I have provided here the Fundamental Canons within the [Code of Ethics](#) of the American Society of Civil Engineers (ASCE):

1. *Engineers shall hold paramount the safety, health and welfare of the public and shall strive to comply with the principles of sustainable development<sup>3</sup> in the performance of their professional duties.*
2. *Engineers shall perform services only in areas of their competence.*
3. *Engineers shall issue public statements only in an objective and truthful manner.*
4. *Engineers shall act in professional matters for each employer or client as faithful agents or trustees, and shall avoid conflicts of interest.*
5. *Engineers shall build their professional reputation on the merit of their services and shall not compete unfairly with others.*
6. *Engineers shall act in such a manner as to uphold and enhance the honor, integrity, and dignity of the engineering profession and shall act with zero-tolerance for bribery, fraud, and corruption.*
7. *Engineers shall continue their professional development throughout their careers, and shall provide opportunities for the professional development of those engineers under their supervision.*

## Homework

Some of the homework assignments will be completed through the UTEP Blackboard website (available through <https://my.utep.edu/>), and some homework assignments will be completed through Quest Learning and Assessment (<https://quest.cns.utexas.edu>), a web-based content and homework delivery system maintained by The University of Texas at Austin. Please go to <https://wikis.utexas.edu/display/questla/Obtaining+a+University+of+Texas+EID> for instructions on how to sign up for the Quest system for this class. During the beginning of this course, when you log into Quest, you will be asked to pay \$30 via credit card on a secure payment site (<https://getquest.cns.utexas.edu/subscriptions/>), which goes toward the maintenance and operation of the resource. You can enroll in the homework portal for this course by searching for the CRN.

Homework assignments will typically be open two to seven days before the due date, and students will be notified by email when assignments are posted on Quest.

## Exams

Exams are open book, open notes, and open homework, and you are allowed to use a calculator. You are NOT allowed to use a cell phone or tablet in any way during the exam. On the date of an exam, you are NOT allowed to communicate in any way with anyone (except the instructor) about the exam. You are required to have a functioning webcam for online proctoring. When you begin the exam, you are required to show a 360° view of your surroundings, and you must show a close up of your calculator so that the brand and model number are readable. If your webcam does not work for part of the exam, your exam grade will be reduced by 10 points per minute that your camera is not working.

## Packback Forum

Packback is an online curiosity community where you can be fearlessly curious and ask big questions about how what we're studying relates to life and the real world. Packback will be assisting you with developing writing skills while enhancing your ability to critically analyze the discussions of this course to draw real-world conclusions. For a brief introduction to Packback Questions and why we are using it in class, watch this video: <https://vimeo.com/163888277>. I believe that your life-long learning is more affected by seeking to know WHY than WHAT. In this course, I want you to empower yourself through deep connections between the course materials and your why. Your time in my course will be brief, but your potential to make the most of your life is great. I hope that through this forum you are able to be inspired by your peers to make the most of your learning.

How to Register on Packback: You will receive a welcome email from [help@packback.co](mailto:help@packback.co) prompting you to finish registration and payment (\$29). Packback has already created an account for you with your UTEP email address, so all you need to do is reset your password. This email may be directed to spam or filtered out, so make sure you do a thorough scan of your inbox if you can't find the email. If you have ANY questions or concerns regarding Packback throughout the semester, please contact the customer support team at [help@packback.co](mailto:help@packback.co).

For this course, your participation on Packback will count towards 20% of your overall course grade. Your Packback grade is based on weekly participation: post one Question and two Responses per week, relevant to the assigned chapter that week. By the end of the semester, you should have posted 15 Questions and 30 Responses to other students' Questions (*i.e.*, a total of 45 posts). Part of your Packback grade will be based on your average Curiosity score; an Average Curiosity Score (ACS) of 90 will constitute full-credit for the Curiosity score component, and an ACS of 65 or less will receive no-credit. The Packback Participation Score (PPS) for this course will be calculated according to the following equation:

$$PPS = \max \left\{ \left( \frac{N_{AW}}{15} \right) \left( \frac{N_Q}{15} \right) \left( \frac{N_R}{30} \right) [4(ACS - 65)], 125 \right\}$$

where  $N_Q$  is the number of questions posted,  $N_R$  is the number of responses posted,  $ACS$  is the Average Curiosity Score of all of your posts for the semester, and  $N_{IW}$  is the number of inactive weeks (no posts).

**Since this is a graduate-level course, in order to catalyze independent thinking and literature review skills, each week you will harness your curiosity around the course topic for that week, and find a peer-reviewed journal article related to your question or response. When you post your question or response, be sure to include the complete DOI hyperlink (*e.g.*, <https://doi.org/10.1039/D0EN00194E>). When you post a response on a classmate's question, find a different peer-reviewed journal article that addresses their question, and be sure to include the complete DOI hyperlink ("http...").** In addition to searching on [Google Scholar](#), here are a few specific recommended journals related to this course, and you should be able to access these for free through the [UTEP VPN](#):

- Journal of Environmental Engineering (<https://ascelibrary.org/journal/joeduc>)
- Environmental Science & Technology (<https://pubs.acs.org/journal/esthag>)
- Water Research (<https://www.journals.elsevier.com/water-research>)
- Journal of Membrane Science (<https://www.journals.elsevier.com/journal-of-membrane-science>)

- Science of the Total Environment (<https://www.journals.elsevier.com/science-of-the-total-environment>)
- Water Environment Research (<https://onlinelibrary.wiley.com/journal/15547531>)

On Packback, each post (question or response) must cite at least one peer-reviewed journal article. If you find a relevant article that does not have a DOI, then it is probably not peer-reviewed. But just because it has a DOI does not guarantee that it is peer-reviewed. I don't have anything against scientific blogs and such, but in a world of social media that is inundated with people passing off their opinion as fact (which is so nauseating!), as engineers, we need to help guide people with objective truth. Of course, the peer-review process does not guarantee truth or accuracy, but it often helps improve accuracy and prevents well-intentioned knuckleheads or agenda-driven self-professed "scientists" from expressing unfounded opinions as "truth". In other words, the peer-review process is at least one barrier to the propagation of nonsense. As a general rule (though not always the case), journals with a higher impact factor tend to be more selective in their publications, so (theoretically), you are less likely to see a junk paper in their journals. I provided the list of some journals (above) that tend to be more trustworthy.

Also, simply listing a citation at the end of your post is insufficient. You need to reference the citation in the post. For example, "According to [insert lead author's last name here] et al. ([insert year of publication here]), [summarize here what you learned from reading the paper]."

Before you start posting, be sure to read the Community Guidelines found in the tutorial on Packback. If your post doesn't follow the Packback Community Guidelines, there is a chance it will be removed and you won't receive points for that post. **There will be a weekly deadline of Sunday at 11:59 PM Mountain Time for submitting posts.** Note: it takes 24 hours for the Packback team to moderate a post and send a coaching email. If by any reason your post is moderated because it does not meet the Community Guidelines, you will need to edit and re-publish your post to receive credit for the week. It is important that you complete your Packback questions and responses several days in advance of the deadline in case your post is moderated. **With respect to the weekly question post, please focus on one of the two lesson topics listed for that week in the course schedule (provided at the end of this syllabus). Please try to post your question by Thursday evening so that everyone has time to post responses before the Sunday night deadline.**

Since this involves weekly professional writing, I encourage you to use this opportunity this semester to improve your technical and professional writing skills. I strongly encourage you to use a grammar check (e.g., <http://www.grammarly.com>) and proofread your questions and responses before posting. Unfortunately, popular culture includes making opinionated statements on social media, but in this platform, we want to postulate questions and make statements based on factual information.

### Team Project

A design project will be performed in teams of no greater than five members. The scope of the project is up to the team (with approval by the instructor) and should be related to the course topic.

### Evaluation

Assessment of your performance in this course will be determined by class attendance and participation, homework quizzes, and exams. (No makeup exams will be offered.) The total course average will be computed by the following:

Evaluation	Contribution (%)
Homework	20
Packback Participation Score	20
Exams (3)	30
Team Project	10
Final Exam	20
Total	100

The final course grade will be determined according to the following:

Average (%)	Grade
≥ 90	A
80-89	B
70-79	C
60-69	D
< 60	F

I reserve the right to modify or augment this grading scheme for the sake of improving the educational effectiveness of this course.

### Copyright Statement for Course Materials

All materials used in this course are protected by copyright law. The course materials are only for the use of students currently enrolled in this course and only for the purpose of this course. They may not be further disseminated.

### General Student Services and Support:

UTEP provides a variety of student services and support:

#### Technology Resources

- [Help Desk](#): Students experiencing technological challenges (email, Blackboard, software, etc.) can submit a ticket to the UTEP Helpdesk for assistance. Contact the Helpdesk via phone, email, chat, website, or in person if on campus.
- [Engineering Technology Center \(ETC\)](#): Engineering software and computer support.
- [UTEP My.Apps](#): server-based software access

#### Academic Resources

- [UTEP Library](#): Access a wide range of resources including online, full-text access to thousands of journals and eBooks plus reference service and librarian assistance for enrolled students.
- [University Writing Center \(UWC\)](#): Submit papers here for assistance with writing style and formatting, ask a tutor for help and explore other writing resources.
- [Engineering Tutoring Center \(ACES\)](#): Tutors are recruited from engineering and science student organizations and honor societies.
- [Math Tutoring Center \(MaRCS\)](#): Ask a tutor for help and explore other available math resources.
- [History Tutoring Center \(HTC\)](#): Receive assistance with writing history papers, get help from a tutor and explore other history resources.
- [RefWorks](#): A bibliographic citation tool; check out the RefWorks tutorial and Fact Sheet and Quick-Start Guide.

#### Individual Resources

- [Military Student Success Center](#): Assists personnel in any branch of service to reach their educational goals.
- [Counseling and Psychological Services](#): Provides a variety of counseling services including individual, couples, and group sessions as well as career and disability assessments.

### Special Accommodations

The University of Texas at El Paso provides, upon request, appropriate academic accommodation for students with disabilities. For more information, contact the Center for Accommodations and Support Services (<https://www.utep.edu/student-affairs/cass/>).

**Tentative Course Schedule**

<b>Week</b>	<b>Day</b>	<b>Lesson</b>	<b>Description</b>	<b>Text</b>
1	Jan 18	1	Intro to Wastewater Treatment	1.1-8
2	Jan 23	2	Wastewater characteristics, flow, and loads	2.1-10; 3.1-7
	Jan 25	3	Wastewater treatment process design	4.1-5, 18.1
3	Jan 30	4	Preliminary and Primary Treatment	5.1-6
	Feb 01	5	Microbiology and metabolism	7.1-4
4	Feb 06	-	<i>Wastewater Treatment Plant Tour</i>	-
	Feb 08	6	<i>Guest Lecture – WW Engr Consulting</i>	-
5	Feb 13	7	Microbial kinetics	7.5
	Feb 15	8	Suspended growth: activated sludge process	7.6, 8.1-5
6	Feb 20	9	Biological nitrification and denitrification	7.9-11, 8.6-7
	Feb 22	10	Biological phosphorous removal	7.13, 8.8
7	Feb 27	11	Wastewater treatment plant modeling	-
	Mar 01	-	<b>EXAM 1</b>	<b>Lessons 1-7</b>
8	Mar 06	12	Aeration	5.10-11, 8.9
	Mar 08	13	Attached growth: trickling filt., RBCs, MBBRs	7.7, 9.1-5
9	Mar 13	-	<i>Spring Break</i>	-
	Mar 15	-	<i>Spring Break</i>	-
10	Mar 20	14	Secondary Sedimentation	5.4; 8.10-11
	Mar 22	15	Membrane bioreactors (MBRs)	8.12, 11.7
11	Mar 27	16	Tertiary treatment: media filt, membranes	11.1-7
	Mar 29	17	Disinfection	12.1-10
12	Apr 03	18	Advanced Oxidation Processes	6.8
	Apr 05	19	Direct Potable Reuse	-
13	Apr 10	-	<i>Fred Hervey Reuse Plant Tour</i>	-
	Apr 12	20	Anaerobic digestion	10.1-5, 13.9
14	Apr 17	21	Sludge treat., biosolids, and resources recovery	13.1-8, 14.1-10
	Apr 19	-	<b>EXAM 2</b>	<b>Lessons 8-15</b>
15	Apr 24	22	Plant recycle flows and nutrient recovery	15.1-6
	Apr 26	23	Air handling and odor control	16.1-6
16	May 01	24	Energy considerations	17.1-10
	May 03	-	<b>EXAM 3</b>	<b>Lessons 16-25</b>
17	May 10	-	<b>FINAL EXAM (7:00-9:45 pm)</b>	<b>(comprehensive)</b>