ENE661 – Environmental Microbiology – Fall 2023 Syllabus

7. **Instructor and office time:**

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Professor.
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2. Lecture time/place: Monday from 6 to 8:50 pm/ In-person (TIER 106) or with WebEx if a virtual online class must be run.
Office Hour: Tuesday/Thursday 11 am-12:30 pm via Webex or in-person by appointment

3. Designation: Core (Required for Environmental Engineering Concentration)

4. Course Description:
This course is a core course required for Environmental Engineering concentration. I will provide an overview of the microbiology of natural and human impacted environment, fundamental microbiology in water treatment engineering, microbial detection methodologies, waterborne disease outbreaks, microbial risk assessment, biotechnologies for renewable energy, and other emerging topics that help enhance your problem-solving skills and increase your knowledge base.

5. Prerequisite:
a. Prerequisite courses: Calculus I, Chemistry, Biochemistry, Biology or permission of the instructor.
b. Graduate students from Civil/Environmental Engineering, Environmental Science, Chemistry, Biochemistry, Chemical Engineering, Biomedical Engineering are welcome to taking this course.
c. Senior undergraduate students from these above majors are possibly allowed to take if they have course works taken related to chemistry, thermodynamics and biochemistry, and biology.

6. Textbook and Other Material:
Primary reference: Handouts and supplemental reading materials provided in the class and will be accessible on Canvas and Dropbox prior to the class.
Secondary references:
(1) Bruce Rittmann, et al., Environmental Biotechnology: Principles and Applications. Second edition. Publication Date: Published: February 11th 2020. ISBN: 9781260441604.
(2) Maier et al., "Environmental Microbiology," Second Edition, Academic Press, 2008. Publication Date: October 3, 2008 | ISBN-10: 0123705193 | ISBN-13: 978-0123705198

You may read papers from relevant journals, which include (but are not limited to): *Applied and Environmental Microbiology, Biodegradation, Environmental Science &*

Technology, Water Research, Water Science & Technology, Biotechnology and Bioengineering, Water Environment Research, J. Environmental Engineering, Microbial Ecology, and Applied Biochemistry and Biotechnology. The following list provides other valuable written resources for this class and your career:
Fundamental references on writing: Strunk, W., Jr. and E.B. White, The Elements of Style, Latest edition, MacMillan Publishing Co., Inc., New York; Glasman-Deal, H., Science Research Writing, Imperial College Press, 2010.

7. Tentative weekly schedule for the topics (subject to minor changes):

Week	Class date	Topic
1	09/11	Introduction to microbiology: importance to society Bioaerosol and engineering treatment Microbial pathogen and health risks (e.g., Covid-19 and other legacy infectious disease-causing microbes)
2	09/18	Microbial assays/biodetection principles Prokaryotic cells and microorganisms, bacterial stability and properties (Webex)
3	09/25	Microscopic techniques
4	10/02	Algal bloom and treatment practices
5	10/9	First laboratory operation
6	10/16	Pathogenic microorganisms Disinfection theories and approaches
7	10/23	Mid-term exam
8	10/30	Review mid-term exam questions Disinfection/EEO
9	11/06	Indicator organisms and fluorescent microscopes and other bacterial detection methods
10	11/13	Basics about viruses DNA/RNA structures
11	11/20	Second lab session
12	11/27	Bacterial growth and kinetics; bacterial energetics; yield coefficient; biomass production/yield;
13	12/04	Biofilm characteristics Activated sludge process-Monod equation; CSTR with/without sludge return; biokinetic coefficient estimation Nitrification/Denitrification principles and applications in wastewater treatment plants
14	12/11	Emerging microbiology topics such as microplastics degradation by microbes in nature MFC systems Bioelectrochemistry and applications Last Class and lecture content review and/or student presentation
15	12/18	Final exam: 6:00PM - 8:30PM @ Same classroom

8. Grading:
Midterm (a) 30%

Final Exam (b)	30%
Two group laboratory reports (c)	10%
Homework/Projects (d)	30%

Grades are usually assessed on a basis of 100 points. Your total final grade=30%·a+30%·b+10%·c+30%·d

Bonus points to elevate the final grade are available. The assessment is based on the active class or laboratory participation, extra work such as sharing class notes and posting responses to other student's questions on canvas.
Penalty points: I know many people get reasons for not being able to show up due to family issues or sickness. If you are absent, you need to send me a note in advance and join the class via Webex if that is possible for you. If you are absent in class or Webex without an early communication, I will take it as absence and take points (one point per absence) off directly from final grades.

9. Term Projects (e.g., lab reports).
In the first two weeks of the term, we will organize into teams of two or three, depending on how many students are registered for the class. We also will choose a topic for each team at that time. I will provide a list of potential topics at the beginning of the term, and teams may also suggest other topics, subject to my approval. A wide variety of topics in environmental pollution, including persistent organic pollutants, oil spills, eutrophication, and heavy metals, with a focus on the underlying chemistry and roles of microbiology and biotechnology in solving these environmental problems will be covered. Each team will have a unique topic. I will provide a schedule with completion milestones to be met by each team during the term. Incremental progress in your term paper will be checked as a regular homework you turn in upon my request, and/or every week you may be requested randomly in advance to orally report with/without PPT about your progress in you research areas and term paper writing. Students are also required to come up with novel or new approaches to solve problems and interpret environmental forensics data as team-based problem-solving activities. These class participations will be graded and recorded as homework or class participation.

I will evaluate each team's work according to the technical quality of its final product, the quality of the written work against the standard of **being suitable for publication in a top-rank journal**, and the quality of the oral presentation against the standard of being suitable for presentation at a top-rank technical conference. The quality of the report and oral presentation includes the effectiveness of the communication.
The basic information and logics that your review paper should deliver are as follows (just fill in with your best answers based on your reading)
1. What are the current knowledge gaps in this topic?
2. What are the challenges in filling in the knowledge gaps such as techniques deficiency and inadequate attention?
3. What are the unique contributions and findings from this review work?

10. Contribution to Meet Professional Component:

- The course is one of the courses that make up the one and one-half years of engineering topics in the civil engineering curriculum.
- The course is one of the courses that provide engineering design experience in the civil engineering curriculum.

11. Course Objective and Curriculum Outcomes:

The course will help engineering students in their new designs aimed at ensuring public and environmental health.

1) Graduates will be able to conduct laboratory experiments and analyze data
2) Graduates will be able to apply basic mathematics and science fundamentals to analyze and design engineering systems
3) Graduates will develop the ability to think inductively as well as deductively – able to acquire and interpret information and develop logical conclusions
4) Graduates will have the knowledge to locate technical references and complete research
5) Graduates will be able to work in teams
6) Graduates will be comfortable in communicating technical information to technical and non-technical audiences
7) Graduates will be conversant with the variety of tools and equipment used in the industry to analyze, design and build civil engineering systems
8) Graduates will be able to use the tools to analyze and design components

12. Laboratory session and selective topics:

Lab #	Potential Subjects
1	The use of air flotation and cationic polymers to enhance the removal of microalgae to mitigate HABs in water
2	Reactive hydrogels for disinfection

13. Accessibility:

Any student who has a need for accommodation based on the impact of a disability should contact the Instructor privately to discuss the specific situation as soon as possible. Contact Disability Resources and Services to coordinate reasonable accommodations for students with documented disabilities. The NJIT web site below provides additional information: http://www.njit.edu/counseling/services/disabilities.php

14. Participation:

Your participation in this class is important. Occasionally we will have in-class example problems and quizzes. Thus, you should bring a calculator with you to class. In addition, students are expected to come to class to learn and no extra assistance on lecture content could be offered through e-mailing, text messaging, or phone calling. Cell phones should also be completely turned off or placed in vibrate mode.

15. Thinking critically and independently:

It is my sincere hope that as a graduate of Engineering, each student will be a thoughtful citizen as well as a fundamentally sound engineer. Your questions, thoughts, and comments are valuable and encouraged throughout this course.

16. Academic integrity:
Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at: http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university. If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu”