ENE661 – Environmental Microbiology – Fall 2017 Syllabus

1. Instructor and office time:

Wen Zhang, PhD, PE,
Associate Professor.
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2. Lecture time/place: Tuesday from 6 to 9 pm/Central King Building 310

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 moodle or dropbox link prior to the class.

Secondary references:

(1) Bruce Rittmann, et al., Environmental Biotechnology: Principles and Applications. Publication Date: July 25, 2000. ISBN-13: 978-0072345537

(2) Maier et al., "Environmental Microbiology," Second Edition, Academic Press, 2008. Publication Date: October 3, 2008 | ISBN-10: 0123705193 | ISBN-13: 978-0123705198

You will 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 changes):

Time	Class date	Topic	Reading Assignments
1	09/05	Introduction to microbiology: Bacteria and viruses; biofilm formation; indicator microorganisms	Ch. 1 (Maier) Ch. 2 Ch. 20
1	09/12	Water sampling/Waterborne and Water-related transmission of microbial pathogens	Ch.8 Ch. 19
2	09/19	Quantitative microbial risk assessment Introduction to Endnote for term paper writing	Ch. 24
3	09/26	First lab (lecture in the lab 414/412 in Colton hall)	
4	10/03	Disinfection theories and approaches	Ch.23
5	10/10	Second lab (lecture in the lab 414/412 in Colton hall)	
6	10/17	Bacterial growth and kinetics; bacterial energetics MFC systems	Ch.3
7	10/24	Mid-term exam	
8	10/31	Microbiology in wastewater treatment-energetics calculation; yield coefficient; biomass production; Activated sludge process-Monod equation; CSTR with/without sludge return; biokinetic coefficient estimation;	Bruce Rittmann's book Ch.6, 7
9	11/07	3rd lab-MFC set up and bring fruit to the class Problem practice and discussion on activated sludge processes	Bruce Rittmann's book Ch.9
10	11/14	Nitrification/Denitrification principles and applications in wastewater treatment plants	Bruce Rittmann's book Ch.9 and 10
11	11/21	No class (Thursday Classes Meet)	
12	11/28	Phosphorus removal; enhanced biological nutrient removal	Bruce Rittmann's book Ch.11
13	12/05	Anaerobic treatment by methanogenesis	Bruce Rittmann's book Ch.13
14	12/12	Last Class and Reading Day	
15		Final exam or TBA by the Institution	

8. Grading:

Midterm 20%
Final Exam 20%

Laboratories (3)	20%
Term Paper/Projects	20%
Quiz/homework	20%

9. Term Projects.
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 participation 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 topics:

Lab #	Subjects
1	Electrical chemical membrane filtration of bacterial suspension
2	Nanobubbles and bacterial inactivation
3	Microwave disinfection with/without catalytic membranes

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:
Students are expected to abide by the spirit of the NJIT Student Code of Conduct. I am intolerant of dishonesty, particularly from aspiring engineers since ethics is a foundation of our profession. Thus, violations of the code of conduct (e.g., cheating in exams and copying homework) will be punished to the fullest extent allowed by university academic policy.