

CEE 6311: *Microbial Principles*

1. Course description and objectives. This course is an overview of basic and applied themes in microbiology. The course introduces principles of microbiology including microbial diversity, microbial evolution, metabolic diversity, and microbial ecology. Microbial processes for industrial and biotechnological applications will be discussed. Specific topics related to environmental engineering will receive particular focus, including microbial nutrition and growth, water and wastewater microbiology, biochemical thermodynamics, and microbial kinetics. Specific learning outcomes are to:

1. Cultivate an appreciation for the diversity and function of microbial life in natural and engineered systems
2. Develop an understanding of key linkages between microbial and engineering processes
3. Use the scientific method to evaluate microbial processes
4. Use principles of microbiology to explain, predict, and harness the activity of microbial communities in natural and engineered systems

2. Course structure. The course consists primarily of lectures and moderated critical discussion.

3. Prerequisites. Familiarity with general biological and chemical principles.

4. Instructor. Joe Brown PhD PE; office: 3226 Ford ES&T; email: joe.brown@ce.gatech.edu; web: <http://brown.gatech.edu>

5. Graduate teaching assistant. Drew Capone; email: drew.s.capone@gmail.com; hours by appointment

6. Lecture. Tuesdays & Thursdays 3:00 – 4:15; Ford ES&T L1125

7. Office hours. By appointment. After class is often best for a quick chat.

8. Text (required). Pepper, I.L., Gerba, C.P., and Gentry, T.J. 2015. *Environmental Microbiology*, 3rd Edition. New York: Academic Press/Elsevier. ISBN 978-0-12-394626-3. Supplementary reading material will be available through the course website. Another (optional but recommended) text for your professional library is Madigan, M.T., et al. 2015. Brock - Biology of Microorganisms, 14th Ed. Prentice Hall, N.J.

9. Course website: Canvas. All lecture slides will be posted. Material developed in class will generally not be posted on the course website.

10. Evaluation. Students will be graded based on quizzes, homework assignments, and three exams.

- **Quizzes.** 10-min, closed book/notes quizzes will be given throughout the term at unannounced dates.
- **Homework.** Homework assignments must be handed in at the start of class on the due date. No homework assignments will be accepted late unless a prior arrangement has been made with the instructor. You may work alone or in groups to complete the homework assignments, but you should solve each problem and turn in your own solutions. If you do work in groups, write the names of the students you worked with at the top of your homework set.
- **Examinations.** Two 50 minute examinations will be given during the term; see course schedule for tentative exam dates. The final exam is comprehensive. Exams will be closed book/notes; equations and required data will be given by the instructor and you will need a calculator. Calculators must not have any communication capability: you cannot use a mobile phone as a calculator during exams. Make-up exams will not be given without written documentation of an illness from an M.D. and confirmation by the Office of the Dean of Students.
- **Grade determination.** The final grade will be calculated as follows: unannounced quizzes (10% bonus), homework (15%), exam I (28%), exam II (28%), final exam (29%).

11. Academic integrity. Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For information on Georgia Tech's Academic Honor Code, please visit <http://www.catalog.gatech.edu/policies/honor-code/> or <http://www.catalog.gatech.edu/rules/18/>. Any student suspected of cheating or plagiarizing on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

12. Accommodations for students with disabilities. If you are a student with learning needs that require special accommodation, contact the Office of Disability Services at (404)894-2563 or <http://disabilityservices.gatech.edu/>, as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

13. Course schedule. Subject to change. Changes will be announced in class.

Class	Date	Topic(s)	Reading (Pepper <i>et al.</i>)
1	20 August	Introduction to the course	
2	22 August	Overview in environmental microbiology	Chapter 1
3	27 August	Microorganisms found in the environment I	Chapter 2
4	29 August	Microorganisms found in the environment II	Chapter 2
5	3 September	Bacterial growth & introduction to redox	Readings on Canvas
6	5 September	Metabolic pathways	Readings on Canvas
7	10 September	Earth & aquatic environments	Chapters 4 & 6
8	12 September	Extreme environments: life on the fringes	Chapter 7
9	17 September	Sampling the environment, microscopy ^{dc}	Chapters 8 and 9
10	19 September	Exam I ^{dc}	
11	24 September	Cultural methods	Chapter 10
12	26 September	Physiological, immunological, & other methods	Chapters 11 and 12
13	1 October	PCR and introduction to other nucleic acid methods ^{dc}	Chapter 13
14	3 October	qPCR, ddPCR, and viability methods ^{dc}	Chapter 13; Readings on Canvas
15	8 October	Microbial source tracking ^{kz}	Chapter 14
16	10 October	Assay development and methods in MST ^{kz}	Readings on Canvas
	15 October	<i>No class: fall break</i>	
17	17 October	Environmentally transmitted pathogens I	Chapter 22
18	22 October	Environmentally transmitted pathogens II	Chapters 22, 23
19	24 October	Quantitative microbial risk assessment I ^{dc}	Chapter 24
20	29 October	Quantitative microbial risk assessment II ^{dc}	Chapter 24
21	31 October	Quantitative microbial risk assessment III ^{dc}	Chapter 24
22	5 November	Antimicrobial resistance ^{al}	Readings on Canvas
23	7 November	Exam II ^{al}	
24	12 November	Microbial communication & interactions	Chapters 19 and 20
25	14 November	'Omics	Chapter 21
26	19 November	Bioenergetics & more on metabolism	Chapter 16
27	21 November	Biogeochemical cycles: C and N	Chapter 16
28	26 November	Microbial kinetics	Readings on Canvas
	28 November	<i>No class: Thanksgiving holiday</i>	
29	3 December	More on microbial kinetics: applications	Readings on Canvas
	10 December (Tuesday), 2:40 – 5:30 PM	Final exam (cumulative) will be held in the same classroom	