JOHN A. REIF, JR. DEPARTMENT OF
CIVIL AND ENVIRONMENTAL ENGINEERING

NJIT New Jersey Institute of Technology

ENE 665 – BIOLOGICAL TREATMENT
SPRING 2025 - SYLLABUS

Instructor: Prof. Arjun Venkatesan, Ph.D.
Colton Hall, Room 217
E-mail: arjun.venkatesan@njit.edu

Office Hours: By appointment (Webex or In-Person)
Tuesdays and Wednesdays: 10:30 am to 11:30 am

Room: COLT 423 **Day and Time:** Thursdays 6:00 PM – 8:50 PM

Description:
This course provides a comprehensive overview of the rapidly evolving field of wastewater engineering, emphasizing technological advancements and regulatory changes over the past decade. Students will explore the following key topics:

- Wastewater as a Resource: Understanding wastewater as a source of energy, nutrients, and potable water.
- Stricter Discharge Requirements: Examining regulations on nitrogen and phosphorus discharges and strategies to meet these standards.
- Microbial Processes: Analyzing the microbiology and physiology of microorganisms involved in nutrient removal and other wastewater treatment processes.
- Return Flow Treatment: Investigating the separate treatment of return flows to enhance nutrient recovery and achieve compliance with stringent discharge standards.
- Sludge and Biosolids Management: Reviewing advancements in sludge treatment and biosolids management to improve efficiency and environmental outcomes.
- Water Reclamation: Advancement in treatment processes to meet water demands and overcome concerns regarding emerging contaminants.

Textbook(s)/Materials Required:

1) "Wastewater Engineering - Treatment and Resource Recovery" 5th Ed., McGraw-Hill, 2014, by Metcalf & Eddy/AECOM. ISBN 978-0-07-340118-8. MHID 0-07-340118-8.

Reference materials:

1) Environmental Biotechnology: Principles and Applications, 2nd Edition, 1260441601 · 9781260441604 by Bruce E. Rittmann, Perry L. McCarty
2) Mackenzie L. Davis, Water and Wastewater Engineering: Design Principles and Practice, 2nd Edition (ISBN: 9781260132274)
3) Handouts/slides

Grading:

Midterm exam 25%
Final Exam 25% Homework assignments/quiz 20% Project and oral presentations 25%
Attendance and class participation (random sign-in sheet) 5%

The final letter grades are computed as follows:
A = > 90.0%, B+ = 85.0% - 89.9%, B = 80.0% - 84.9%, C+ = 75.0% - 79.9%, C = 70.0% - 74.9%, F = < 69.9%

Tentative class schedule

WEEK	TOPIC	READING
1	Introduction; wastewater flowrate and characteristics; regulations.	1-1 to 1-6 3-1 to 3-6 (Chapter 2)
2	Reaction kinetics and process analysis	1-7 to 1-11 (Appendix H and I)
3	Process selection and general design considerations, equalization	3-7 4- 1, 2, 3, 4
4	Physical treatment (I): screening, size reduction, grit removal, and sedimentation	5-1, 5-2; 5-4 to 5-7
5	Physical treatment (II): sedimentation, floatation, and aeration	5-8, 5-10, 11; 8-10, 8-11
6	Microbiology Review	7-1 to 7-4
7		Mid-term exam
8	Suspended growth (I)	7-5, 7-6, 7-8, 7-9, 8-1 to 8-3
9	Suspended growth (II)	8-4 to 8-6, 8-9, 8-12
10	Attached growth	Chapter 9
11	Suspended growth (III) – nutrients removal	7-9, 7-13, 8-6 to 8-8
12	Anaerobic treatment	Chapter 10
13	Sludge treatment I – sludge thickening and anaerobic digestion	13-1 to 13-3, 13-5 to 13-7, 13-9,

POLICIES & PROCEDURES

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: NJIT Academic Integrity Code.

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.

Generative AI:
This course expects students to work on homework problems without artificial intelligence (AI) assistance in order to better develop their skills in this content area. As such, AI usage is not permitted for solving homework problems. However, student use of AI is permitted for the term project. The extent of usage will be discussed in class when students are assigned term projects. Additionally, if and when students use AI in this course, the AI must be cited as is shown within the NJIT Library AI citation page for AI. If you have any questions or concerns about AI technology use in this class, please reach out to your instructor prior to submitting any assignments.

Communication: All communications by the instructor will be during the class and via NJIT e-mail. It is your responsibility to check your NJIT e-mail regularly. Expect an e-mail response/reply from the instructor only on Monday - Friday between 9am - 5pm.

Lectures/Class: Some weekly lectures will start with quizzes. During the class, the instructor can often ask you to work on a problem or brainstorm ideas with the people next to you and you will be called on to provide one or more of your answers. The goal of this in-class work and discussion is to get you started on a problem (not necessarily to finish) and improve how you think about the problem which will then be discussed. Lectures will NOT be recorded for subsequent access to students; therefore, students have the burden of making up for missed lectures. Please be respectful to the course instructor and your classmates. You should always bring a pencil and calculator with you to class. Please put your cell phones on silent or turned off during class.

No late homework is accepted (no exceptions): Homework assignments must be handed in or submitted before the beginning of the class. Assignments must be typed; however, hand sketches (as necessary) may be submitted. If plots or calculations are required, either use hand calculations of the problem in your submitted HW solution or you can use Excel program and attach the solution excel files along with pdf homework submissions. Begin each problem on a new page and number all pages; collate all homework pages together and have your name written clearly on the front page. It is your responsibility to make sure you understand how to solve the problems by attending office hours with the instructor/TA and/or asking questions in class. As with many conceptual problems, multiple solutions may be possible. This means that all rational solutions to the assignments may be considered for acceptance. Homework will be due at the beginning of class on the date it is due. Late Homework will NOT be accepted after the due date. The homework should be turned in as instructed before 6 pm.

Exams: There will be two exams held during class time: midterm and final exam. All exams in this course will be in-person. No electronic devices (such as laptops/cellphones/tablets/smart watches, etc.) are allowed during quizzes/exams. No recording devices shall be allowed during class or examinations.

Term Project and Presentation: There will be a term project/assignment for this course that must be carried out as a group. This term project is made up of two parts: (1) term project paper/report, and (2) term project presentation. Necessary background information and knowledge, in addition to the expectations and format of the term project will be provided during class lectures throughout the semester.

Quizzes. There will be short (15 - 25 min.) quizzes given during class. These quizzes primarily cover recent material. Quizzes will require both essay and mathematical proficiency and will be based largely on homework problems and reading. Quizzes are in the closed-book/closed-notes format.

Instructor Commitment: You can expect the instructor to be courteous, punctual, organized, and prepared for lecture and other class activities; to answer questions clearly; to be available during office hours or to notify you beforehand if office hours are moved; to provide a suitable guest lecturer or pre-recorded lecture when they are traveling or unavailable; and to grade uniformly, fairly, and consistently.

Students with Documented Disabilities: NJIT is committed to providing students with documented disabilities equal access to programs and activities. If you have, or believe that you may have, a physical, medical, psychological, or learning disability that may require accommodations, please contact the Coordinator of Student Disability Services located in the Center for Counseling and Psychological Services, in Campbell Hall, Room 205, (973) 596-3414. Further information on disability services related to the self-identification, documentation and accommodation processes can be found on the webpage at:
(http://www.njit.edu/counseling/services/disabilities.php).

CEE Mission, Program Educational Objectives and Student Outcomes

The undergraduate program leads to a Bachelor of Science degree in Civil Engineering (CE), producing graduates who will, within 3-5 years:

1. Engineering Practice: Alumni will successfully engage in the ethical practice of civil engineering within industry, government, and private practice, working toward safe, practical, resilient, sustainable solutions in a wide array of technical specialties including construction, environmental, geotechnical, structural, transportation, and water resources

2. Professional Growth: Alumni will advance their technical and interpersonal skills through professional growth and development activities such as graduate study in engineering, research and development, professional registration and continuing education; some graduates will transition into other professional fields such as business and law through further education.

3. Service: Alumni will perform service to society and the engineering profession through membership and participation in professional societies, government, educational institutions, civic organizations, charitable giving and other humanitarian endeavors.

Students from the CE program will attain (by the time of graduation):

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Updated 1/6/2025