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Spring 2022

CE 360-102: Sustainable Civil Engineering Materials

Marwa Korayem

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Course Syllabus
CE 360: Sustainable Civil Engineering Materials- Spring 2022
John A. Reif, Jr. Department of Civil and Environmental Engineering

Course Information

Title: CE 360-102, Sustainable Civil Engineering Materials
Class Location: GITC 1400

Meeting Times: Tuesdays 6:00 PM – 8:50 PM
Credit Hours: 3 Credits

Instructor

Marwa M. Korayem, Ph.D.
Email: mi45@njit.edu

My WebEx https://njit.webex.com/meet/mi45

Information on using WebEx can be found: https://ist.njit.edu/webex/

Information using Canvas can be found: https://canvas.njit.edu/getting-started-canvas

Required Pre-requisites

The required prerequisites for this course are MECH 237 and CHEM 121.

Course Description

The course provides instruction on civil and construction engineering materials used in the construction of civil engineering projects such as pavements, bridges, buildings, retaining walls, tanks, etc. Additionally, the fundamentals of sustainability within the context of civil engineering will be discussed. In particular, the course concentrates on the engineering properties of aggregates, wood, metals, portland cement concrete (PCC) and hot-mix asphalt (HMA) as well as the mixture design of PCC and HMA, as well as other advanced civil engineering materials. These materials will be used to discuss sustainability and sustainable design within civil engineering contexts.

Topics: Civil and construction engineering materials; aggregate, portland cement concrete, asphalt concrete, wood, metals. Standard test methods. Sustainability. Sustainable design. Chemistry, mechanics, and durability of materials.

Learning Outcomes

Upon completion of this course, students will be able to:

1. Define sustainability in their own words and relate how sustainability is defined in the context of new construction as well as renovation and rehabilitation.

2. Demonstrate concepts of life-cycle analysis including economic and sustainability aspects and apply these concepts to sustainable construction.
3. Identify key material properties important to the successful application of aggregates, asphalt concrete, portland cement concrete, wood and metals to a variety of civil works.
4. Specify aggregates, concrete and asphalt mixtures, metals, and wood for typical construction applications including the use of appropriate standards (i.e. ASTM) for testing and specification of said materials.
5. Design a PCC mixture and an HMA mixture using sustainability concepts that will be durable and meet the requirements of a particular construction project.

Required Reading Materials

Required

A. *Design and Control of Concrete Mixtures*, Kosmatka, S.H. and Wilson, M.L., 16th Edition, Portland Cement Association, 2015

B. Pavement Guide Interactive: http://www.pavementinteractive.org/ (free internet resource)

C. Additional course reading materials will be posted on the Canvas course website throughout the term.

Additional

Virtual Superpave Laboratory: http://training.ce.washington.edu/VSL/
Portland Cement Association: www.cement.org
American Concrete Institute: www.aci-int.org

Homework Assignment Requirements and Grading

Homework assignments will be posted on the course website regularly throughout the term. Students will have at least 7 days to complete homework assignments from the date they are posted. Homework will be collected and graded in the following manner:

- All problems will be checked for completeness.
- One question (chosen at random) will be graded for correctness, professionalism and legibility

Method of Collection. All homework will be collected via Canvas, the course website. Homework must be submitted by 11:59:59 PM on the day it is due. Please note the following items:

- Homework must be turned in as 1 single file. If you need to combine typed responses with hand written calculations, you must scan in your hand-written portions, and import them into the word document that you have typed or inserted as a page into the PDF.
- It is the student's responsibility to ensure that the homework is correctly uploaded to Canvas. If you are having issues with Canvas contact the Canvas help desk, the professor is not able to help with IT/Technical issues.

- Turning in the homework at 12:00:00 AM or after on the day after the homework is due will still count as a late homework. It is recommended you plan to turn in your assignment earlier than the deadline to ensure any uploading issues are able to be fixed and you can turn your homework in on time.

Homework assignments are expected to look professional and be legible. Up to 25% of each homework will include points for meeting the criteria below. Homework assignments will meet the following requirements:

- Each page will have a header that includes student name, date, course number, assignment, and page number.
- All homework will be completed on fresh paper with clean edges (not ripped out of a notebook). Engineering paper is preferred when completing assignments by hand.
- Assignments **do not** have borders around the pages or unnecessary cover pages.
- Written sections have correct grammar and spelling.
- Handwriting is legible
- Each question is clearly labeled, with the given information, what you are required to answer, and the solution clearly marked.

Assignments must be submitted by 11:59:59 PM on the date they are due through Canvas.njit.edu. Any assignment turned in later than this time be considered late unless prior arrangements are made with the instructor. **Late homework will be accepted up to 24 hours after the assigned due date and time for a loss of 25% of the earned points and for a loss of 50% after 48 hours.** No late homework will be accepted after 48 hours.

Grade Determination

The course grade will be determined using the following point breakdown:

Homework Assignments	125 Points total (5 Homework assns. at 25 points each)
Quizzes and Exercises	100 Points total (5 Quizzes and 5 Exercises at 10 points each)
Exam 1	75 Points total
Exam 2	75 Points total
Final Examination	125 Points total

The course is scored out of a total of 500 points. Grading will not be completed according to a curve Letter grades will be determined using the following guidelines:

A = 450 points and above
B+ = 425 – 449 points
B = 400 – 425 points
C+ = 375 – 399 points
C = 350 – 374 points
D = 325 – 349 points
F = Below 325 point

Course Exams

Three exams will be given during the term, two during the term and a final exam. Each regular exam will be out of 75 points, and the final exam will be out of 125 points. The final exam will

be cumulative of the whole semester. Exams will include both a multiple-choice portion, calculation sections, and a written response portion.

Missed examinations will not be allowed to be made up without prior consent from the professor. If a student will be missing an examination, please contact the professor at least **24 hours prior** to missing the exam.

If you have an emergency and miss an exam without prior approval from the professor, you must contact the Dean of Students who will review your case and determine whether an absence should be allowed.

Plagiarism and Copying

Plagiarism and copying will *not* be tolerated in this course. While it is encouraged that you discuss and work together on homework problems, direct copying of each-others answers is prohibited. Many homework assignments require written responses and each student is expected to write their own response.

Plagiarism is also not tolerated. Plagiarism is when you use someone else's words, ideas, assertions, data, or figures and do not acknowledge that you have done that (i.e. pass it off as your own original work). If you use the words, ideas, or even phrases from someone else or any published material you must:

1. Use quotation marks around the copied words or phrases AND cite the source; or
2. Paraphrase or summarize using your own words and phrases AND cite the source.

Any charts, graphs, data, images, or numerical information used from another source or published material must also be cited. If you are not familiar with citations please work with an NJIT librarian to learn more. This is all material that should have been covered in your first-year writing courses.

Student assignments will be submitted via a plagiarism detection software. Any evidence of plagiarism, copying, or cheating during exams, on homeworks, or on quizzes will result in an immediate grade of zero for the assignment and will be reported to the dean of students. A second instance of this will result in a failing grade for the course.

Extra Credit

No extra credit will be offered for the course. The grading is designed to give students many chances to do well in the course. For more information why extra credit is not offered please review the following website:

https://www.math.uh.edu/~tomforde/NoExtraCredit.html

Course Reading

You are required to complete the readings for the course prior to each class. The reading has been chosen to support the material given in class and should be given full attention.

Course Schedule

Note: Course schedule is tentative and may change throughout the term. The instructor will communicate any changes. Class time is provided for topics of particular interest to students, or to provide additional instruction if class is running behind. Students wishing to suggest a special topic should speak with the instructor. The course schedule is attached at the end of this syllabus.

Students with 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)

Academic Dishonesty and Student Conduct

(Taken from the NJIT Academic Integrity Code linked below)

New Jersey Institute of Technology is an institution dedicated to the pursuit of knowledge through teaching and research. The university expects that its graduates will assume positions of leadership within their professions and communities. Within this context, the university strives to develop and maintain a high level of ethics and honesty among all members of its community.

Imperative to this goal is the commitment to truth and academic integrity. This commitment is confirmed in this NJIT University Code on Academic Integrity. The essential quality of this Code is that each student shall demonstrate honesty and integrity in the completion of all assignments and in the participation of the learning process. Adherence to the University Code on Academic Integrity promotes the level of integrity required within the university and professional communities and assures students that their work is being judged fairly with the work of others. For more information on the code of academic integrity please see: http://www.njit.edu/education/pdf/academic-integrity-code.pdf

E-mail communication with the professor and each other is expected to be professional. Any e-mails received by the professor that are not professionally formatted and stated will not be answered. Examples of professional e-mail etiquette can be found at the following links:

http://www.wikihow.com/Write-a-Formal-Email
http://englishlive.ef.com/blog/write-perfect-professional-email-english-5-steps/
https://owl.english.purdue.edu/owl/resource/636/01/

This syllabus is subject to change at the discretion of the instructor throughout the term.

If you have any questions, please contact me at mi45@njit.edu

Date	Lecure Topic	Reading
1/18/2022	Course Introduction, Introduction to sustainability	
	Material Life Cycle	Ashby Chapter 3 - Sections 3.1-3.3 (On Canvas)
1/25/2022	Material Life Cycle (Cont.)	
	Life Cycle Assessment	Ashby Chapter 3 Sections 3.4 -3.7 (On Canvas)
2/1/2022	Sustainability and Construction Materials	None
	Aggregates Introduction	D&C: Chapter 8
2/8/2022	Aggregates	PGI: Aggregates Section (Link on Canvas)
		D&C: Chapters 1,2, and 3
2/15/2022	Introduction to Cement and Concrete	D&C: Chapters 1,2, and 3
	Cement Production	D&C Chapter 5: Pgs 105-114, 123-125
2/22/2022	**Midterm Exam 1**	
	Cement Hydration	D&C Chapter 5: Pgs 125-141
3/1/2022	Properties of Fresh Concrete	D&C Chapter 12: Pg 259 - 274
	Properties of Hardened Concrete	D&C Chapter 12: Pg 274-284, Chapter 13: Pgs 287-296, 301-305, Chapter 14: All
3/8/2022	Concrete Mixture Design	D&C Chapter 15& 16
		D&C Chapter 17 and 18
3/15/2022	No Class - Spring Break	None
3/22/2022	Concrete mixture Design Recap	
	Supplementary Cementing Materials and Sustainable Concrete Mixtures	D&C Chapter 6
3/29/2022	**Midterm Exam 2**	None
	Crystalline Materials	None
4/5/2022	Metals and Corrosion	None
	Concrete Reinforcement	D&C Chapter 11
4/12/2022	Asphalt Pavement Introduction	PGI Aspahlt Introduction (Links on Canvas)
	Asphalt Binder Selection	PGI Aspahlt Binder Sections (Links on Canvas)
4/19/2022	Asphalt Mixture Design	PGI Asphalt Mixture Design (Links on Canvas)
4/26/2022	Recap	
5/3/2022	No Class - Friday Schedule	
TBD	**Final Exam**	TBD

Matrix – CE 360 Sustainable Civil Engineering Materials

Strategies, Actions and Assignments	ABET Student Outcomes (1-7)	Program Educational Objectives	Assessment Measures
Objective 1. Define sustainability in their own words and relate how sustainability is defined in the context of new construction as well as renovation and rehabilitation.			
Discuss what sustainability is in the context of construction and construction materials.	1, 3, 4, 7	1, 3	Homework, quizzes, exams, in-class exercises
Write a cohesive definition that incorporates the ideas of the three pillars of sustainability.	1, 2	1	Quizzes, exams
Objective 2. Demonstrate concepts of life-cycle analysis including economic and sustainability aspects and apply these concepts to sustainable construction.			
List and explain the various steps of completing a life cycle analysis.	2, 4	1	Quizzes, Exams
Describe the different types of life cycle analyses and the reasons why someone may choose a particular method.	1, 4	1	Quizzes, Exams
Objective 3. Identify key material properties important to the successful application of aggregates, asphalt concrete, portland cement concrete, wood and metals to a variety of civil works..			
List and define the key components of aggregates, concrete, asphalt, wood, and metals.	1, 4, 7	1	Quizzes, Exams
Describe the different material properties that affect fresh properties, mechanical properties, and durability properties.	2, 4	1, 2	Quizzes, Exams
Objective 4. Specify aggregates, concrete and asphalt mixtures, metals, and wood for typical construction applications including the use of appropriate standards (i.e. ASTM) for testing and specification of said materials.			
Identify the properties needed for specific applications of each material.	1, 4	1	Homework, In-Class Exercises, Exams
Discuss the various service and environmental loadings that a constructed element may experience and what properties are needed to resist those loadings.	2, 3	1, 2	Homework, Exams, Quizzes, In-class exercises
Objective 5. Design a PCC mixture and an HMA mixture using sustainability concepts that will be durable and meet the requirements of a particular construction project.			
Design a concrete mixture using the volumetric method.	1, 2	1, 2	Homework, Exams, In-Class Exercises
Choose materials for and design an asphalt mixture according to the Superpave process	1, 2	1, 2	Homework, Exams, In-Class Exerccises

CEE Mission, Program Educational Objectives and Student Outcomes

The mission of the Department of Civil and Environmental Engineering is:

- to educate a diverse student body to be employed in the engineering profession
- to encourage research and scholarship among our faculty and students
- to promote service to the engineering profession and society

Our program educational objectives are reflected in the achievements of our recent alumni:

1 – Engineering Practice: Alumni will successfully engage in the practice of civil engineering within industry, government, and private practice, working toward 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 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.

Our Student Outcomes are what students are expected to know and be able to do by the time of their 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

Revised: 2/13/18