Fall 2023

# CE 210-003:Construction Materials and Procedures

Fadi Karaa

Dr. F. Karaa Fall 2023

**CE 210-003: CONSTRUCTION MATERIALS & PROCEDURES**

Class Hours

Mon Wed 10:00 AM- 11:20 AM CULM 111 (First Day of Classes September 6, 2023)

Office Hours (Office or Virtual)

Mon 12:15 PM- 1:45 PM and Wed 12:15 PM- 1:45 PM or by e-mail or phone appointment at (973) 642-4198 or karaa@njit.edu

REQUIRED TEXT
Halpin, Daniel W. and Senior, Bolivar A., Construction Management, 5th Edition Wiley, and ISBN: 9781119256809. This textbook is referred to as DH in the lecture readings and other references below.

OTHER REFERENCE

Other files are assigned electronically as supplemental readings and will be e-mailed to class participants. These are denoted in course outline as Efiles.

Prerequisite: HUM 101. Introduction to construction management organization, contracts, construction safety, engineering economics, and engineering ethics. Studies current practices of heavy construction including soil and rock excavation productivity, and building construction materials and procedures. Field trips to construction sites provide opportunities to directly view many of the practices.

*"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

COURSE DESCRIPTION AND OBJECTIVES:

This course is a general comprehensive course on construction management and engineering in the Civil and Environmental Engineering Department at NJIT. It provides a broad understanding of the construction environment, the engineering and construction project management process and development process, with particular emphasis on planning, scheduling and cost management, which are key pillars of successful construction management. Also, the various tools and techniques and their interactions in the cost-effective development of constructed facilities, will be covered with practical illustrations and complemented by hands-on exercises and case studies.

LEARNING OUTCOMES

This course covers the environment, planning and management issues related to the modern approach of construction management. Using the cases and background materials, and methodologies covered, you should be able to:

- Analyze the feasibility of a construction project within resource constraints.
- Understand the basic structure of the construction industry, its environment, its various sectors and its overall relationship to the US and global economy.
- Devise the best organizational structure capable of carrying out the project.
- Understand engineering economic principles and apply the concepts of life-cycle management of a constructed project from the owner's perspective (feasibility, financing, rate of return, contract management, quality control).
- Define the role of the general contractor, and understand the perspective of the GC as a business (estimating, bidding, project financing, cash flow management, materials and operations management).
- Understand the components of modern Professional Construction Management, and its relationships to other project participants as a form of project delivery.

COURSE OUTLINE (Subject to updating throughout semester)

| Week | Dates | Textbook/Reading | Assignment (*) | Topics |
|---|---|---|---|---|
| 1 | 6 Sep | DH Chapter 1,2 | As posted in Canvas | History and Basic Concepts of Construction; Bid Package Development |
| 2 | 11, 13 Sep | DH Ch. 2 (ctd.), 3, 4 | As posted in Canvas | Development Cycle for Projects (ctd.), Contracts |
| 3 | 18, 20 Sep | DH Ch 5, 6 | | Alternative Project Delivery Systems/ Legal Aspects/ Taxes |
| 4 | 25 Sep, 27 Sep | Chapter 6(ctd), E-File | As posted in Canvas | Impact of Taxes/Depreciation of Assets- Project Organization Structures |

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|---|---|---|---|---|
| 5 | 2 Oct, 4 Oct | DH Ch 7; DH Ch 8 | MS project WBS Model | Project Planning WBS); Project Scheduling (1) |
| 6 | 9, 11 Oct | DH Ch 8 (ctd.); | Problem 8.2, Bonus Assignment figure 8.26 MS Project generalized relationships | Quiz 1/ Project Scheduling (2); |
| 7 | 16, 18 Oct | DH Ch 10 | Resource Leveling and Time-Cost Trade-Off problems | Resource-Related and Linear Scheduling; Computer applications |
| 8 | 23, 25 Oct | DH Ch 9 | PERT Problem | Construction Materials (Part I)/ PERT Advanced Scheduling |
| 9 | 30 Oct, 1 Nov | DH Ch 11 | Future and Present Values; Lifecycle costing | Mid-Term/ Present and Future Values; Lifecycle Costing; |
| 10 | 6, 8 Nov | DH Ch13 | Problem Project Funding | Project Funding |
| 11 | 13, 15 Nov | DH Ch 13 (ctd.) | | Project Funding Case |
| 11 | 15, 17 Nov | Handout, Dh Ch. 19; | TBA | Construction Materials and Properties (Part 2); Building Systems** |
| 12 | 20 Nov | Engineering Ethics Handouts and Case | Ethics Assignment I | Engineering Code of Ethics – Knowledge and Case |
| 13 | 27 Nov, 29 Nov | DH Ch 17, Ch 14 | Problem: Equipment Balance Planning Ethics Case | Overview of Cost Estimating; Productivity Based Estimating ; Equipment Ownership Costs, Spread; Construction labor, safety |
| 14 | 4, 6 Dec | DH Ch 15 | | Equipment Productivity – Heavy Construction, Review |
| 15 | 11 Dec, 13 Dec | Class review | | |
| 16 | 17 December | Finals Start | | |

Final Exam Period: December 17-23.

*Actual Assignments may differ from list and can be changed by Instructor during Semester.

GRADING:

The overall term grade will be based on the following elements:

Paper/Project Case Study: 17.5%

Quiz 1: 10%
Homework: 20%
Class Participation/attendance: 10%
Mid-Term: 17.5%
Final: 25%

## Field Trip Reports

Each student will submit two (2) reports, which can be 2 Parts of the same project on self-conducted field trips according to the following schedule:

1. Project Administration: In this first part, you will establish for a construction project of your choice, or a section of the class field trip project:
   a- The project background, scope, budget, staging and key milestones.
   b- Understanding of the contract and project delivery system, relationships between parties, progress measurement/payment, change order management.
   c- Description of the Construction Methods and Materials, and an engineering evaluation of a key project component (e.g. foundation design, etc.)
   d- A Preliminary Work Breakdown Structure.
   Part 1 is due October 22 at 5PM.
2. Project Planning, including:
   a- A detailed Work Breakdown Structure for all building systems and work elements
   b- A MS Project CPM Schedule integrated with a cost estimate to enable cost/schedule integration.
   Part 2 is due Dec 8 at 5PM.

**Outline and Content Elements for Each (Part of) the Field Trip Reports:**

1. *Introduction:* Identify the project, its location and the type of construction. Give the dates of your visitation. Identify the Owner, Contractor, and Architect-Engineer.

2. *Field Investigation:* Describe the project in detail based on your field visitation. Report on the present stage of construction. Report on the labor, equipment, and materials on the job. Report on production rates. Report any discussions with personnel (see note below).

3. *Engineering Evaluation:* Present your own evaluation of the equipment, materials, and procedures being used on the project based on your knowledge from CE 210. Suggest alternatives that might improve job progress and efficiency. Discuss any environmental and safety aspects of the project.

4. *Appendix:* (If any) Present applicable codes, manufacturer's literature, news articles, web links, etc.

5. *Figures and Photographs:* These or sketches are strongly recommended. Refer to all figures and photos in the body of the report.

Note: Make certain that you do not disrupt the ongoing construction activities during your visit. Always check first with the person-in-charge, usually the project superintendent, upon your arrival. Be courteous and remember, construction managers are busy people.

Report Format and Grading: The report should be word processed on 8.5 x 11 in. bond paper and electronic file submitted on Canvas. Correct grammar and spelling are required. Grading will be based on (1) Technical content, (2) Communication effectiveness including organization, grammar, spelling, clarity, and neatness. Suggested length of the text portion of each of the 2 Parts of the report is at least 4 pages.

**Outcomes Course Matrix – CE 210-003 Construction Materials & Procedures**

| **Strategies, Actions and Assignments** | **ABET Student Outcomes (1-7)** | **Program Educational Objectives** | **Assessment Measures** |
|---|---|---|---|
| **Student Learning Outcome 1: Explain terms used to describe construction materials, methods and procedures used in heavy building construction management and construction management and organization.** | | | |
| Introduce the United States system of delivery of engineering and construction services | 4 | 1, 2, 3 | Homework, quizzes and exams |
| Introduce equipment labor and methods used in heavy and building construction | 7 | 1 | Homework, quizzes and exams |
| **Student Learning Outcome 2: Apply the process of job site planning, scheduling and construction productivity estimating.** | | | |
| Introduce critical path method scheduling | 1, 2 | 1 | Homework, quizzes and exams |
| Introduce methods used to calculate and estimate excavation equipment productivity | 1, 2 | 1 | Homework, quizzes and exams |
| **Student Learning Outcome 3: Discuss construction contracts in the context of the United Sates legal system.** | | | |
| Introduce the United States legal system and contracts | 4 | 1, 3 | Homework, quizzes and exams |

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| Present the NCEES model rules of professional conduct | 4 | 1, 3 | Homework, quizzes and exams |
| Introduce the role of OSHA and construction site safety | 4 | 1, 2. 3 | Homework, quizzes and exams |
| **Student Learning Outcome 4: Observe and report on construction project site visits.** | | | |
| Visit construction sites and observe the project status and operations at the site. | 3 | 1, 2 | Field reports. |
| Introduce engineering economics and its role in selection of alternatives. | 7 | 1, 2 | Homework, quizzes and exams. |

**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

Fall 2023 Academic Calendar

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|---|---|---|
| Sept | 4 | Labor Day. University Closed |
| Sept | 5 | First Day of Classes |
| Sept | 11 | Last Day to Add/Drop a Class |
| Sept | 11 | Last Day for 100% Refund, Full or Partial Withdrawal |
| Sept | 12 | W Grades Posted for Course Withdrawals |
| Sept | 18 | Last Day for 90% Refund, Full or Partial Withdrawal - No Refund for Partial Withdrawal after this date |
| Oct | 2 | Last Day for 50% Refund, Full Withdrawal |
| Oct | 23 | Last Day for 25% Refund, Full Withdrawal |
| Nov | 13 | Last Day to Withdraw from Classes |
| Nov | 21 | Thursday Classes Meet |
| Nov | 22 | Friday Classes Meet |
| Nov | 23 | Thanksgiving Recess Begins. No Classes |

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| Nov | 26 | Thanksgiving Recess Ends |
| Dec | 13 | Last Day of Classes |
| Dec | 14 | Reading Day 1 |
| Dec | 15 | Reading Day 2 |
| Dec | 16 | Saturday Classes Meet |
| Dec | 17 | Final Exams Begin |
| Dec | 23 | Final Exams End |
| Dec | 25 | Final Grades Due |