



## National University of Engineering (UNI)

School of Civil Engineering  
Syllabus 2026-II

### 1. COURSE

CE2C2. Construction Technology I (Mandatory)

### 2. GENERAL INFORMATION

|                            |                                                     |
|----------------------------|-----------------------------------------------------|
| 2.1 Course                 | : CE2C2. Construction Technology I                  |
| 2.2 Semester               | : 7 <sup>th</sup> Semester.                         |
| 2.3 Credits                | : 3                                                 |
| 2.4 Hours                  | : 2 HT; 1 HP;                                       |
| 2.5 Duration of the period | : 16 weeks                                          |
| 2.6 Type of course         | : Mandatory                                         |
| 2.7 Learning modality      | : Face to face                                      |
| 2.8 Prerequisites          | : CE3M1. Concrete Technology. (4 <sup>th</sup> Sem) |

### 3. PROFESSORS

Meetings after coordination with the professor

### 4. INTRODUCTION TO THE COURSE

Construction Technology I covers construction methods, equipment, and productivity, including earthmoving and construction processes for concrete and steel structures. The course also includes safety and risk management on construction sites, and an introduction to digital construction technologies (BIM) for project management.

### 5. GOALS

- Select appropriate methods, equipment, and construction processes for earthmoving operations and structural construction.
- Measure and analyze the productivity of construction operations.
- Apply safety and risk management principles on construction sites.
- Use BIM tools for digital management of construction projects.

### 6. COMPETENCES

**ABET-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. (Usage)

**ABET-1)** An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. (Usage)

**ABET-6)** An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. (Usage)

### 7. TOPICS

| Unit 1: Construction Methods, Equipment, and Productivity (38 hours)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
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| Competences Expected: ABET-2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Learning Outcomes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <ul style="list-style-type: none"> <li>• Earthwork operations: excavation, hauling, compaction, and mass diagrams</li> <li>• Concrete construction: formwork, placing, finishing, and curing</li> <li>• Steel erection, connection, and safety procedures</li> <li>• Construction equipment types, capabilities, and selection criteria</li> <li>• Productivity measurement, cycle time analysis, and crew balancing</li> <li>• Heavy civil construction methods for tunnels, dams, and bridges</li> <li>• Equipment economics: ownership vs. rental, depreciation, and operating cost</li> <li>• Trenchless technologies and deep excavation support systems</li> <li>• Automation and robotics in construction operations</li> </ul> | <ul style="list-style-type: none"> <li>• Select appropriate construction equipment for common earthwork and material handling tasks [Usage]</li> <li>• Design basic formwork and shoring for a concrete slab or wall [Assessment]</li> <li>• Explain the sequence and safety considerations for steel erection [Familiarity]</li> <li>• Calculate productivity rates and cycle times for equipment operations [Usage]</li> <li>• Balance a construction crew to optimize productivity for a given task [Assessment]</li> <li>• Compare construction methods for a heavy civil project like a cut-and-cover tunnel [Assessment]</li> <li>• Analyze the economic life and hourly cost of a piece of construction equipment [Usage]</li> <li>• Describe the applications and limitations of trenchless construction technologies [Familiarity]</li> <li>• Evaluate the potential for automation to improve safety and productivity on a construction site [Assessment]</li> </ul> |
| <b>Readings :</b> [Peu+18]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

| Unit 2: Construction Safety, Health, and Risk Management (4 hours)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
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| Competences Expected: ABET-1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Learning Outcomes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <ul style="list-style-type: none"> <li>• Safety management systems and the role of safety culture</li> <li>• Common construction hazards: falls, struck-by, electrocution, caught-in/between</li> <li>• Occupational Safety and Health Administration (OSHA) regulations and compliance</li> <li>• Risk identification and assessment techniques (e.g., JSA, checklists)</li> <li>• Hierarchy of controls: elimination, substitution, engineering, administrative, PPE</li> <li>• Occupational health: silica, noise, ergonomics, and industrial hygiene</li> <li>• Emergency response planning and incident investigation</li> <li>• Insurance and bonding principles for construction risk transfer</li> <li>• Proactive safety leading indicators and predictive analytics</li> </ul> | <ul style="list-style-type: none"> <li>• Identify the "Fatal Four" construction hazards and basic OSHA requirements for each [Familiarity]</li> <li>• Conduct a Job Safety Analysis (JSA) for a common construction task [Assessment]</li> <li>• Develop a site-specific safety plan for a given project scenario [Usage]</li> <li>• Apply the hierarchy of controls to mitigate an identified safety risk [Familiarity]</li> <li>• Evaluate occupational health exposures (e.g., noise, dust) and recommend monitoring strategies [Assessment]</li> <li>• Create an emergency response plan for a construction site [Usage]</li> <li>• Explain the purpose and types of insurance (e.g., CGL, workers' comp) in construction risk management [Familiarity]</li> <li>• Propose leading safety indicators to track and predict site safety performance [Assessment]</li> </ul> |
| Readings : [Hin05]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

| Unit 3: Building Information Modeling (BIM) for Digital Delivery and Asset Management (2 hours)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
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| Competences Expected: ABET-6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Learning Outcomes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <ul style="list-style-type: none"> <li>• BIM concepts: dimensions (3D, 4D, 5D, 6D, 7D), LOD, and LOIN</li> <li>• BIM authoring tools and parametric modeling techniques</li> <li>• Model coordination, clash detection, and interference checking</li> <li>• Collaboration platforms, Common Data Environments (CDE), and BIM execution plans</li> <li>• BIM-based analysis: quantity takeoff, energy simulation, and structural analysis</li> <li>• Digital twins and the connection between BIM and operational data</li> <li>• Interoperability standards: IFC, COBie, and open-BIM</li> <li>• Asset information models (AIM) and BIM for facilities management (FM)</li> <li>• Regulatory submission and automated code compliance checking</li> </ul> | <ul style="list-style-type: none"> <li>• Define the different dimensions of BIM (3D-7D) and their associated information [Familiarity]</li> <li>• Create a basic 3D parametric model of a structural framing system using BIM software [Usage]</li> <li>• Perform a clash detection analysis between architectural and structural models [Assessment]</li> <li>• Outline the key components of a BIM Execution Plan (BEP) [Familiarity]</li> <li>• Extract a material quantity takeoff schedule from a BIM model [Usage]</li> <li>• Explain the relationship between a BIM model and a digital twin for an asset [Familiarity]</li> <li>• Export a BIM model using the IFC format to ensure interoperability [Usage]</li> <li>• Develop an Asset Information Model (AIM) deliverable for handover to a facility manager [Assessment]</li> <li>• Evaluate the potential of automated rule-checking for building code compliance [Assessment]</li> </ul> |
| Readings : [Eas+18]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

## 8. WORKPLAN

### 8.1 Methodology

Individual and team participation is encouraged to present their ideas, motivating them with additional points in the different stages of the course evaluation.

### 8.2 Theory Sessions

The theory sessions are held in master classes with activities including active learning and roleplay to allow students to internalize the concepts.

### 8.3 Practical Sessions

The practical sessions are held in class where a series of exercises and/or practical concepts are developed through problem solving, problem solving, specific exercises and/or in application contexts.

## 9. EVALUATION SYSTEM

\*\*\*\*\* EVALUATION MISSING \*\*\*\*\*

## 10. BASIC BIBLIOGRAPHY

- [Hin05] Jimmie W. Hinze. *Construction Safety*. 2nd. Prentice Hall, 2005.
- [Eas+18] Chuck Eastman et al. *BIM Handbook: A Guide to Building Information Modeling*. 3rd. Wiley, 2018.
- [Peu+18] Robert L. Peurifoy et al. *Construction Planning, Equipment, and Methods*. 9th. McGraw-Hill, 2018.