

CEE 4730 - Reinforced Concrete

Spring 2026

AY 2025-26: CEE 4730-Reinforced Concrete 3 credits

Class Times: T and TH 4:25-5:40PM

Location: 002 Kalkin Hall

Prerequisites: CEE-170

Description: Concrete is the most versatile and popular construction material in the world. Structures such as buildings, bridges, dams, tunnels, offshore platforms, sports arenas, and nuclear power plants are built with reinforced and(or) prestressed concrete. In this class you will learn the fundamental mechanics necessary to understand the behavior of concrete structures and the design procedures used in the United States. The course will focus on reinforced concrete beams, columns, retaining walls, and one-way slab elements. The course will also present the fundamental mechanics behind prestressed concrete. The course material will be presented in the context of the design of reinforced concrete buildings of low and moderate height subject to typical loading conditions.

Textbook: *Design of Reinforced Concrete 10th Ed.* Jack McCormac and Russell Brown

Other texts: *Simplified Design: Reinforced Concrete Buildings of Moderate Height 3rd Ed.* Iyad Alsamsam and Mahmoud E. Kamara. Portland Cement Association

Reinforced Concrete Design 3rd Ed. (Schaum's Outlines). Noel J. Everard

ACI 318 - Building Code Requirements for Structural Concrete and Commentary.
American Concrete Institute.

<https://www.concrete.org/tools/318buildingcodeportal.aspx.aspx>

Instructor: Dr. Eric M. Hernandez

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Office hours: T and TH 2:00-3:00PM or upon request.

Objectives:

- Understand the mechanical behavior of reinforced concrete elements and systems
- Analyze and design structural elements using ACI-318
- Analyze and design reinforced concrete building systems using ACI-318

Topics:

- Material Properties: Steel and Concrete
- Design Criteria for Concrete Structures: Load and Resistance Factor Design (LRFD)
- Analysis of Reinforced Concrete Building Systems and Load Paths
- Design for Flexure
- Design for Shear and Torsion

- Detailing of Reinforcement
- Design of Columns (combined axial and bending)
- Design of One-way Slabs and Retaining Walls
- Basics of Prestressed Concrete

Apps: Excel, MATLAB, SAP2000

Grading: Assignments 50% Projects 50%

Class Assignments and Exams:

Assignment 1 – Materials: 1.1 – 1.11. Due 1/20

Assignment 2 – Loads, Load Paths, and Analysis: Handout. Due 1/27

Assignment 3 – Elastic Stresses in Flexure and Compression: 2.1, 2.3, 2.5, 2.9, 2.19, 2.27, 2.41. Due 2/5

Assignment 4 – Flexure Analysis of Beams: 3.1-3.5, 3.7, 3.9. Due 2/12

Assignment 5 – Design for Flexure: 4.11, 4.13, 4.15, 4.17, 4.19, 5.19, 5.21. Due 2/24

Assignment 6 – Deformation in Beams: 6.1-6.5. Due 3/5

Assignment 7 – Design for Shear: 8.1, 8.2, 8.5, 8.7, 8.9. Due 3/24

Assignment 8 – Design for Torsion: 15.1, 15.6, 15.7, 15.11. Due 4/7

Assignment 9 – Reinforcing Details and Anchorage: 7.1-7.5, 7.21, 7.29, 9.1-9.5. Due 4/21

Assignment 10 – Design for Combined Flexure and Axial (Columns): 10.9, 10.11, 10.15. Due 4/30

Final Exam – Submit Final Project Due: May 7th

ABET Outcomes

Below a description of the 7 ABET Outcomes and how this course contributes to the fulfillment of such outcomes:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics (High)
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 (High)
3. An ability to communicate effectively with a range of audiences (NA)
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 (Medium)
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 (Medium)

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

7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies (High)

UVM POLICIES – Read Carefully

Student Learning Accommodations: In keeping with University policy, any student with a documented disability interested in utilizing accommodations should contact ACCESS, the office of Disability Services on campus. ACCESS works with students to create reasonable and appropriate accommodations via an accommodation letter to their professors as early as possible each semester. Contact ACCESS: A170 Living/Learning Center; 802-656-7753; access@uvm.edu; www.uvm.edu/access UVM's policy on disability certification and student support: www.uvm.edu/~uvmppg/ppg/student/disability.pdf

Religious Holidays: Students have the right to practice the religion of their choice. If you need to miss class to observe a religious holiday, please submit the dates of your absence to me in writing by the end of the second full week of classes. You will be permitted to make up work within a mutually agreed upon time.

Academic Integrity: The policy addresses plagiarism, fabrication, collusion, and cheating. www.uvm.edu/~uvmppg/ppg/student/acadintegrity.pdf Grade Appeals: If you would like to contest a grade, please follow the procedures outlined in this policy: www.uvm.edu/~uvmppg/ppg/student/gradeappeals.pdf

Grading: For information on grading and GPA calculation, go to www.uvm.edu/academics/catalogue and click on Policies for an A-Z listing. Code of Student Rights and Responsibilities: www.uvm.edu/~uvmppg/ppg/student/studentcode.pdf

FERPA Rights Disclosure: The purpose of this policy is to communicate the rights of students regarding access to, and privacy of their student educational records as provided for in the Family Educational Rights and Privacy Act (FERPA) of 1974. <http://www.uvm.edu/~uvmppg/ppg/student/ferpa.pdf>

Final exam policy: The University final exam policy outlines expectations during final exams and explains timing and process of examination period. www.uvm.edu/academics/catalogue2010-11/?Page=allpolicies.php&SM=policymenu.html&policy=Examinations