

CEE 3700 Structural Analysis
Spring 2025

- AY 2024-25:** CEE-3700 Structural Analysis 3 credits
- Class Times:** M W F 10:50 – 11:40 AM
- Location:** 002 Kalkin Hall
- Prerequisites:** MATH-3201, MATH-2542 or MATH-2522, CE-2100 (or ME-1140), CS-1210
- Description:** The inherent strength and stiffness possessed by solids, which allows stable forms to exist is their *structure*. Some structures arise in nature; while others are engineered by humans. The objective of this course is to provide the conceptual framework that enables a rational understanding of structural forms and the analytical tools necessary to analyze structures subject to stresses and strains within the linear-elastic range of the constitutive material.
- Textbook:** *Structural Analysis 9th Edition*. R.C. Hibbeler, Prentice Hall 2014
- Other texts:** *Structures 7th Edition*. D.L. Schodek and M. Bechthold, Pearson 2014.
Structural Analysis 5th Edition. A. Ghali, A.M. Neville and T.G. Brown, Spon Press 2003
Structural Analysis. J. Liable, Holt Rinehart and Winston Press 1985
Theory and Problems of Structural Analysis Jan Tuma, Schaum's Outline Series 1969
- Req. Reading:** *Why Buildings Fall Down* by Matthys Levi and Mario Salvadori
- Materials:** 30°/60° and 45° set squares, mechanical pencil, calculator, engineering paper, laptop. If you prefer to draw in AUTOCAD or SolidWorks, that is acceptable/preferred.
- Instructor:** Dr. Eric M. Hernandez
Office: 371 Votey Hall
E-mail: eric.hernandez@uvm.edu
Office hours: T TH 1:00-3:00 pm
- Objectives:**
1. Present fundamental theory of structures. Equilibrium-Compatibility-Constitutive laws.
 2. Provide tools for modeling structural systems subject to loading and environmental effects.
 3. Develop expertise in analyzing statically determinate structural systems; this includes computation of reactions, internal forces, stresses and deformations using analytical and graphical methods.
 4. Introduce analytical methods of solutions for statically indeterminate structures.
- Topics:**
- Review of pre-requisites: Statics, Strength of Materials, Matrices, MATLAB
 - Equilibrium-Compatibility-Constitutive laws
 - Types of structures
 - Loads on structures
 - Cables and arches
 - Analysis of statically determinate structures (beams, frames and trusses)

- i. Analysis of internal forces in structural systems (graphical and analytical methods)
 - ii. Influence lines for statically determinate structures
- Computation of deflections
 - i. Second-order differential equation
 - ii. Energy methods
 - iii. Virtual work
- Analysis of statically indeterminate structures by superposition (flexibility method)
- Introduction to the stiffness method in structural analysis

Computer Usage: MATLAB (req.), AUTOCAD (opt.), SolidWorks (opt.).

Grading:	Assignments	20%
	Projects	40%
	Exams	30%
	Reading Assignment	10%

Instructions for assignments and midterms (READ CAREFULLY)

All assignments must have a cover page indicating: the university, course name/number, instructor, student's name, assignment number and due date. Every problem must include the problem statement (could be a copy of the textbook problem statement). All calculations must be made by hand on engineering paper (or using a digital pen on virtual paper). All results must have units and expressed to 2 decimal places. If possible, all figures must be drawn to scale either by hand with rulers and/or set squares or using CAD software (points will be deducted for free-hand drawings that are not accurate). All pages must be numbered sequentially starting with 1 at the cover page and must have the student's name and assignment number on them. Aesthetics and organization will be part of the grade. Late assignments will not be accepted. Assignments/projects that do not comply with any of these instructions will not be graded.

Instructions for Book Report

Every Wednesday you are required to submit a 300-word (minimum) summary of a chapter of the book *Why Buildings Fall Down* by Matthys Levi and Mario Salvadori. This should be a single-page summary. The reading of each chapter should take between 30 and 60 minutes, while the writing should take between 60 and 90 minutes.

Class Assignments and Exams:

Chapter 1 – Types of Structures and Loads: 1-3, 1-5, 1-11, 1-12, 1-15, 1-17, 1-25. Due 1/31

Chapter 2 – Analysis of Statically Determinate Structures: 2-11, 2-19, 2-25, 2-27, 2-31, 2-41. Due 2/21

Chapter 3 - Analysis of Statically Determinate Trusses: 3-1, 3-5, 3-11, 3-21, 3-37. Due 3/7

Chapter 4 – Internal loadings Developed in Structural Members: 4-1, 4-7, 4-17, 4-27, 4-33, 4-39. Due 3/14

Chapter 5 – Cables and Arches: 5-3, 5-5, 5-9, 5-11, 5-23, 5-27. Due 3/28

Chapter 6 – Influence Lines for Statically Determinate Structures: 6-3, 6-17, 6-21, 6-39, 6-59, 6-71. Due 4/4

Chapter 8 – Deflections in Beams: F8-1, F8-3, F8-5, 8-1, 8-3, 8-7, 8-9. Due 4/11

Chapter 9 – Deflections Using Energy Methods: 9-1, 9-11, 9-19, 9-25, 9-21, 9-51. Due 4/25

Chapter 10 – Analysis of Statically Indeterminate Structures by the Force Method: 10-1, 10-9, 10-13, 10-15, 10-19, 10-27, 10-33, 10-40. Due 5/2

Final Exam – Submit Final Project Due: May 9th

ABET Outcomes

Below find 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 (Medium)
3. an ability to communicate effectively with a range of audiences (Medium)
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 (NA)
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 (NA)
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