

**CGN 4910 - CIVIL ENGINEERING CAPSTONE  
(STRUCTURES, GEOTECH and CONSTRUCTION)  
SPRING 2020**

“The capacity to design includes more than mere technical competence. It involves a willingness to attack a situation never seen or studied before and for which data are often incomplete; it also includes an acceptance of full responsibility for solving the problem on a professional basis.”

Report of the Committee on Evaluation of Engineering Education, “The Grinter Committee,” 1955.

“A human being should be able to change a diaper, plan an invasion, butcher a hog, conn a ship, design a building, write a sonnet, balance accounts, build a wall, set a bone, comfort the dying, take orders, give orders, cooperate, act alone, solve equations, analyze a new problem, pitch manure, program a computer, cook a tasty meal, fight efficiently, die gallantly. Specialization is for insects.”

Robert A. Heinlein, “The Notebooks of Lazarus Long,” 1978.

**INSTRUCTOR:** Monrad Thue, P.E. Senior Structural Engineer, GSE Engineering & Consulting, Inc.  
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Office Hours: 30 minutes after each class; or by appointment.

**DESCRIPTION:**

This course addresses the requirements for design and document preparation faced by practicing structural, geotechnical, and construction engineering professionals. Included will be **open-ended problems** that require investigation, analysis, synthesis, and implementation. The problems associated with the class work and team projects will not have one specific answer, rather they will require research and iterative solutions as commonly occurs in the practice of engineering. During weekly lectures, the instructor and guest lecturers will share personal experiences to illuminate what engineers do on a daily basis.

This course will emphasize the importance and the application of good communication during the design phases of a project, the importance of teamwork and appreciation of the different personalities within a team, the importance of ethical practice and leadership, and the importance of developing design documents that clearly convey required information on how to build structures. **Modules will be presented to students prior to the week’s classes. The material in these modules (Videos-PDFs-Word Documents) are intended to cover the main topics that will help students understand how engineering and design is practiced, and help team members with their final project and presentations. These modules are to be studied prior to class so that students will come to class with questions on the specific information in the modules, and will research additional information on their own for discussion during class. This class is considered to be collaborative between students and faculty/guest lecturers.**

**ABET REQUIREMENT:** Students must be prepared for engineering practice through a curriculum culminating in a major design experience based on the knowledge and skills acquired in earlier course work. This design experience shall incorporate the design of a system, component or process to meet the desired needs of the Final Project RFP. Students will be expected to

incorporate appropriate engineering standards and multiple realistic constraints and to function within a **multidisciplinary team**. Effective oral and written communication skills will be emphasized during individual homework assignments, individual oral presentations and the completion of the Final Project Documents and the Final Team Presentations. Engineering ethics and leadership will be part of the curriculum.

### **REQUIRED RESOURCES:**

1. *Practical Concepts for Capstone Design Engineering* by Bloetscher & Meeroff.
2. *Steel Construction Manual*, 14th Edition (AISC 325-11), American Institute of Steel Construction
3. ACI 318-10, *Building Code Requirements for Structural Concrete*, American Concrete Institute
4. ASCE 7-10 Minimum Design Loads for Buildings and Other Structures
5. 2014 or 2017 Florida Building Code (FBC)
6. Revit and AutoCAD to prepare documents
7. MathCAD, Excel, or similar program(s) to prepare calculations
8. Visual Analysis or similar program(s) for structural analysis
9. Technical Specifications <http://www.csinet.org/>
10. UF Facilities and Standards
11. Other material as provided by instructor

**TIME:** Tuesday, Thursday Period 9 & 10 (see attached schedule) 4:30 – 6:00 PM ZOOM (FLG 0265)  
Possibly other times and places for special topics and field trips.

**REQUISITES:** Students are expected to be in their last year of undergraduate studies.

### **COURSE OBJECTIVES:**

1. Develop an appreciation for the place of analysis, professional ethics, and team-work in the design and construction of structures and foundation systems. Develop an appreciation for the role of the contractor in successful construction projects.
2. Learn to collaborate and work with team members with different backgrounds, skills and knowledge.
3. Develop skills in understanding fundamental behavior of real structures.
4. Develop skills in developing effective geotechnical reports.
5. Develop an understanding/knowledge of the cost estimating process.
6. Demonstrate communication skills required for engineering practice.
7. Through the student design teams, develop the comprehensive design of a building structure, including construction plans, specifications Table of Content, and cost estimate(s). Present written results of that design in a professional manner, and make team oral presentations.

**TOPICS TO BE COVERED:** (Subject to Change - addition or deletion or change of order)

1. Building Codes and Standards
2. Load paths and Load calculations
3. Structural and geotechnical design
4. Working with Building Construction professionals

5. Effective communication
6. Effective teamwork
7. Ethics and leadership
8. Development of construction documents

### CLASS REQUIREMENTS:

1. **Please be pleasant and respectful.** As a class, you will gain much by what you collectively put in. Good communication skills (both written and verbal) are a major part of the course objectives and can best be achieved if you work well together. This class provides the opportunity to learn about engineering practice from a practicing engineer. Take advantage of this opportunity by coming to class prepared and inquisitive.
2. **Attendance is required due to the collaborative nature of the class.** The instructor retains the right to reduce final letter grades for excessive absences or lack of participation, regardless of total points earned.  
Good communication with the instructor and respect for your team and class members will ensure that class attendance does not adversely affect your grades.
3. **Please be on-time to class.** The instructor will start class at 5:10 PM and will endeavor to end class no later than 6:45pm. Please do not start closing books, etc., as a way of informing the instructor that you feel that the class is over.
4. **Preparation by the student prior to the lecture is required. Study/read the assigned material, especially the material in the modules prior to the lecture. Pop quizzes should be anticipated.**
5. **Homework will be assigned and may be individual or group work as indicated.** Unless otherwise noted, working with fellow students on homework will be allowed as "self-help," but the final homework which is turned in must represent the work of the individual student or individual group as the case may be. Do not copy another student's work or plagiarize work from other sources. Homework is due at the end of the class period designated and late homework will be marked down 5 points (out of 100) for each class period it is not submitted.  
Homework will be submitted on engineering computation paper or as computer output. ONLY ONE PROBLEM PER SHEET. Number and label all pages. Work neatly. All work will be graded on the basis of content and neatness. Use straightedges, reasonable scales, use pencil (that means also using an eraser), and print and label clearly. Reference equations to codes or other resources (e.g.: AISC Eq. 4-1). List assumptions or rationale for your work. Sloppy or difficult to follow work will be returned ungraded. No exceptions.
6. No make-up work will be allowed, except in cases of emergencies or civic responsibilities (jury duty, etc.), provided that the instructor is notified by e-mail in advance. Provisions for make-up work will be determined on a case-by-case basis.
7. Most class communication to students from the instructor will be by means of UF Canvas or email account through the class listserv. Check Canvas and your e-mail regularly (at least daily). Keep the instructor informed of any changes to your e-mail address. Failure on the part of the student to keep up with e-mail communications is not excusable. **Keep your e-mailbox empty enough to accept emails with large attachments. Bounced emails are the responsibility of the student.**

8. **You are strongly encouraged to vote this November.**

**GRADE APPEALS:**

General: At any time that you do not understand the solution to a homework problem or quiz, please contact Mr. Thue. However, if you believe that a grade was assigned in error, please comply with the following procedures:

Please carefully consider what you did wrong. If you still believe that an incorrect grade has been assigned, you must make your case in writing unless a meeting is possible or preferred. You must provide substantial information as to why your grade should be changed. Your request for re-grading must be received no later than 14 calendar days after the work or quiz has been returned.

**CLASS FORMAT:**

Class will meet at the assigned time. Because of the occasional use of professional consultants and guest lecturers the syllabus must be flexible. Team presentations will be scheduled ahead of time, and may be scheduled for the evening or other out-of-class times. Each team will consist of ten (10) members, with five members participating in the first presentation, and the other five members participating in the last presentation. Teams are required to meet at least once a week outside of the class meeting.

**PERFORMANCE EXPECTATIONS:**

Attend class on time and prepared  
Participate  
Ask questions  
Submit assignments on time

**ATTENDANCE POLICY:**

Attendance will be taken and absences will be noted. Excessive absences will be cause for a reduction on the final grade assigned. For every two unexcused absences the final grade will be marked down one full grade.

**ACCOMMODATION FOR DISABILITIES:**

Students requesting classroom accommodations must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the instructor when requesting accommodation.

**GENERAL GRADING RULES**

The UF policies for passing grades and assignment of grade points can be found at the following URL:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

The following criteria will be used in grading homework and quizzes:

Lines drawn freehand (i.e.: no straightedge)

Minus 10% of total available

Work otherwise sloppy or difficult to follow

Minus 10% to 100% of total available

These point deductions will be applied as the instructor or grader sees fit. I like to assign partial credit for problems with incorrect answers, but I cannot assign partial credit if I cannot follow or otherwise decipher your work to find the incorrect step without expending excessive effort.

#### **GRADING: GRADING SCALE:**

A	$\geq 92.5$	
A-	$\geq 89.5 - 92.4$	
B+	$\geq 87.5 - 89.4$	
B	$\geq 82.5 - 87.4$	
B-	$\geq 79.5 - 82.4$	
C+	$\geq 77.5 - 79.4$	
C	$\geq 72.5 - 77.4$	
C-	$\geq 69.5 - 72.4$	
D	$< 69.5$	

Assignments #4, #5, #6, the two Quizzes, and the two Oral Presentations (team grade and individual grade) will hold equal weight in grading each student. Scores for Assignments #1, #2, #3, and #7 will be added to the final grade average and will each have a net effect of zero for meeting the basic requirements, -1 point for poor work, -4 points for incomplete work, and +1 point for outstanding work,

#### **IMPORTANT UNIVERSITY INFORMATION**

##### Academic Honesty:

All students admitted to the University of Florida have signed a statement of academic honesty committing to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a student at the University of Florida and to be honest in all work submitted and exams taken in this class and all others.

**COURSE OUTLINE:** *Subject to change or modification*

WEEK	DATE	ACTIVITY AND MATERIAL TO BE COVERED IN CLASS	ASSIGNMENTS AND PREPARATION FOR NEXT WEEK'S CLASS MEETING
1	Sept. 1 (1)  Sept. 3 (2)	Introduction - Discussion on Modules, Class Description, Team Projects, Expectations.  Instructor's Oral Presentation. Discuss Teamwork, Communication and Responsibilities of Engineers. Team Selection.	<b>Assignment #1:</b> Prepare resumes and on-line oral presentation for the upcoming semester. Oral presentations will include describing your personal background, your engineering education/career goals, and personal interests. Presentations will be between 2 and 3 minutes long. Resumes are due with Assignment #2.  Modules 1 & 2. Read Chapter 1 and Chapter 5 (p.71-88; 96-98).
2	Sept. 8 (3)  Sept. 10 (4)	<b>Oral Presentations on-line as scheduled.</b> Discussion on Module 1 & 2 (Overview and Plans Preparation). On-line discussion on plans preparation. Teams to meet and begin hand drawn plans and sections for Assignment #2.  <b>Oral Presentations on-line as scheduled.</b> Hand out PQS and discuss PQS and Revit. Teams to work on Assignment #2.	<b>Assignment #2 (due 9/24 - 2 weeks):</b> Each student to develop preliminary hand-drawn framing plans for building and sludge tanks, and submit resumes in coordinated format with team members. TEAMS to submit cover letter for PQS response and TEAM organization chart.  Module 3  <b>Assignment #3 (due 10/15 – 5 weeks):</b> TEAMS to develop Revit Models for Final Project. Read handouts on Presentations and Technical Writing.
3	Sept. 15 (5)  Sept. 17 (6)	<b>Oral Presentations on-line as scheduled.</b> Discussion on Module 3 – Loads and Load Path. Teams to work in-class on Assignment #2 and #3.  <b>Oral Presentations on-line as scheduled.</b> Teams to work on Assignment #2 and #3.	Module 4  <b>Assignment #4 (due 10/22 – 5 weeks):</b> TEAMS to develop written proposal in response to PQS. Read first half of Chapter 13.

4	Sept. 22 (7)	Oral Presentations on-line as scheduled. Discussion on Module 4 – Wind loads, Shear Walls and Diaphragms.	Module 5  <b>Assignment #5 (50% due 11/12 – 7 weeks, and 100% due 12/8 – 11 weeks):</b> TEAMS to develop plans, sections and calculations for Final Project. Read second half of Chapter 13.
	Sept. 24 (8)	<b>Assignment #2 Due.</b> Oral Presentations on-line as scheduled.	
5	Sept. 29 (9)	Discussion of Module 5 – Foundations and Geotechnical Reports	Teams to work on developing STAGE-I presentations and write-up coinciding with PQS.
	Oct. 1 (10)	<b>TEAMS TO MEET WITH PROFESSOR OUTSIDE REITZ UNION AS SCHED.</b> All teams to work on Assignment #4.	Module 6A, 6B, 6C  TEAMS TO STUDY/PRACTICE FOR PHASE-1 PRESENTATIONS
6	Oct. 6 (11)	Discussion on Module 6A & 6B – Design of Sludge Holding Tanks and Operations Building. On-line lecture on Assignment #5.	<b>Assignment #6 (due 12/8 – 9 weeks):</b> TEAMS to develop geotechnical reports. Read articles on <i>Geotechnical Engineering</i> .  Module 6A, 6B, 6C  TEAMS TO STUDY/PRACTICE FOR PHASE-1 PRESENTATIONS
	Oct. 8 (12)	<b>GUEST LECTURE–Geotechnical Engineering</b>	
7	Oct 13 (13)	Discussion on Module 6C – Members in compression, flexure and shear. Teams to meet on-line as scheduled.	Read chapter 7 & 14.  TEAMS TO STUDY/PRACTICE FOR PHASE-1 PRESENTATIONS
	Oct 15 (14)	<b>Assignment #3 Due</b> Teams to meet on-line as scheduled.	
8	Oct 20 (15)	Teams to work on presentation.	Module 7
	Oct 22 (16)	<b>Assignment #4 Due</b> <b>STAGE-I PRESENTATIONS</b>	
9	Oct. 27 (17)	<b>GUEST LECTURE – Ethics and Leadership.</b>	Read articles on <i>Building Codes and Standards, and Design Delivery Process</i> .  Discussion of Module 7 - Ethics Discussions on <i>Building Codes and Standards, and Design Delivery Process</i> .
	Oct. 29 (18)		

10	Nov. 3 (19)  Nov. 5 (20)	<b>GUEST LECTURE – Practicing Architect.</b>  <b>CASE STUDY</b> presentation by teams. General Discussion.	Read Chapter 4 (pages 49-63).
11	Nov. 10 (21)  Nov. 12 (22)	<b>CASE STUDY</b> presentation by teams. General discussion.  Team/professor meetings as scheduled. <b>50% Draft of Assignment #5 due (see description at right).</b>	<b>This submittal will be not be graded, but insufficient work will require another meeting the following week, at which time insufficient work will lower the final team grade by at least 10%.</b>
12	Nov. 17 (23)  Nov. 19 (24)	<b>Test #1 on everything covered to date, and writing. CASE STUDY</b> presentation by teams. General discussion.  Team/professor meetings as scheduled.	TEAMS TO STUDY/PRACTICE FOR FINAL PRESENTATIONS
13	Nov. 24 (25)  Nov. 26 (26)	<b>TEAMS TO MEET PROFESSOR OUTSIDE TBD – Hand in Test #1.</b>  <b>HOLIDAY</b>	TEAMS TO STUDY/PRACTICE FOR FINAL PRESENTATIONS
14	Dec. 1 (27)  Dec. 3 (28)	Team/professor meetings as scheduled.  Team/professor meetings as scheduled.	<b>Assignment #7 (due Dec. 8 – 1 week):</b> Individuals to write a 200 word reflection: “How I Would Have Changed My CE Education and Why”  TEAMS TO STUDY/PRACTICE FOR FINAL PRESENTATIONS
15	Dec. 8 (29)  Dec. 10 (30)	<b>FINAL TEAM PRESENTATIONS Assignment #5 with corrections, #6 and #7 Due.</b>  <b>READING DAY</b>	
16	Week of Dec. 14	<b>EXAM WEEK</b>	