University of Connecticut
Department of Civil & Environmental Engineering
CE 2410 Geomatics and Spatial Measurements

Fall Semester 2019
Lecture: Tuesday and Thursday 9:30–10:45AM Gentry 131

Instructors:
Dr. Amy Burnicki (amy.burnicki@uconn.edu) Office hours: M 2:30-4:30PM Castleman 326, or by appointment

Course Description:
Introduction to various data measurement issues in civil and environmental engineering, including collection techniques, analysis, error evaluation, and visualization; Topics include leveling, distance and angle measurement, mapping and topographic surveys, GPS and Geographic Information Systems (GIS), geospatial frames of reference.

Course Objectives:
Upon successful completion of this course, students will gain a basic understanding of geomatics theory and practice and will be able to:

1. Explain and determine horizontal and vertical position
2. Solve basic geomatics problems using geometry and trigonometry
3. Describe how to measure and visualize terrain
4. Calculate and minimize error in data collection
5. Create and interpret various data visualizations, including planimetric maps, topographic maps and site plans
6. Summarize the role of geographic reference systems & common coordinate systems in data collection and mapping
7. Use geomatics equipment to perform basic data collection, including Total Stations, automatic levels and GPS
8. Apply GIS and computer-aided drafting (CAD) software to visualize spatial data
9. Work as a member of an integrated team to collect, analyze and visualize geospatial data

Textbook (Optional):
Surveying: Principles and Applications, 9th edition, Barry F. Kavanagh and Tom B. Mastin, Pearson

Supplementary Readings drawn from:
Surveying Fundamentals and Practices, 6th edition, Jerry A. Nathanson, Michael Lanzafama, Philip Kissam, Prentice Hall
Introduction to Geospatial Technologies, 2nd edition, Bradley A. Shellito, W.H. Freeman and Company

Additional Required Materials:
Surveying field notebook: ELAN 64-8x4W or Sokkia Engineers Field Book
Basic scientific calculator

- examples of acceptable calculators: Texas Instruments TI-30Xa or Casio FX-260
- graphing calculators **will not** be allowed during exams

Prerequisites:
MATH 1060Q or 1120Q or 1131Q

Course Policies:
In class:

- Arrive to the classroom on time and respect your classmates and instructor by keeping quiet during the lecture.
- Refrain from answering phone calls or texting during the lecture; laptops should be used for note taking only.
- Clarifying questions related to the presented material will be addressed during lecture; however, specific questions or concerns should be addressed after class or during office hours.

- Include the course number in all email correspondence.
- Emails sent after 5pm and before 9am or during weekends may not be answered until the next business day.

In lab:

- Your participation in the lab sessions is **mandatory**.
  - A student who fails to attend a lab session will receive a 0 for the missed lab session.
- Arrive to lab on time and prepared for the week's activity.
- Students are expected to follow all safety rules and regulations. Safety rules and general lab policies will be covered, in detail, during the first lab meeting.
- **Lab sessions will be held regardless of the weather**; dress appropriately.
- **The equipment in this class costs thousands of dollars.** Follow handling/use instructions given before or during the labs.
- Data collection in the field requires teamwork. Students will work as part of a geomatics team throughout the semester.
  - Your performance in lab will be evaluated by your teaching assistants and teammates after each lab session.
- See Laboratory syllabus for complete set of Lab Policies.

Academic integrity

- The instructor of this class has a **zero-tolerance policy** for academic misconduct, that is copying others' work either in lab, on an assignment, or on an exam. Any student work that is found to be in violation of the university policy regarding academic misconduct (http://www.community.uconn.edu/student_code.html) will be assigned a grade of zero at a minimum. Students with multiple offenses are at risk of failing the course.

Student conduct

- You are responsible for acting in accordance with the University of Connecticut's Student Code. In particular, note the following: "*The spirit of inquiry can only flourish in an environment of mutual trust and respect, and that environment cannot be limited to the classroom or to the lab. Each member of the community must have the opportunity to participate fully in the process of learning and understanding if the community as a whole is to remain strong and vital. Therefore, all members must accept responsibility for creating an environment that promotes individual growth and builds community through the safe, respectful exchange of diverse thought, opinion, and feeling.*"

Course Evaluation:

Letter	A	A-	B+	B	B-	C+	C	C-	D+	D	F
Points	>=93	90-92.9	87-89.9	83-86.9	80-82.9	77-79.9	73-76.9	70-72.9	67-69.9	60-66.9	<60

Grading:

Your grade will be based on your performance on:

Homework (20%)	Lab Exercises (20%)	Semester project (20%)
Lab Practical (5%)	Midterm exams (20%)	Final exam (15%)

Homework Assignments:

- You will have weekly homework assignments. Each assignment will consist, on average, of 5-6 problems.
- Assignments will be posted to HuskyCT by noon on Wednesday and are ***due by the end of the day (11:59pm) the following Tuesday***.
- Homework assignments must be submitted as a **single** document to HuskyCT.
  - Submitted assignments must include your name and lab section.
  - Assignments can either be hand written and scanned to create a single pdf document OR typed and saved as a docx or pdf document. ***If illegible, your homework will not be graded.***
  - Every calculation used in your response must be included in your submitted document; i.e., **all work must be shown to earn full credit**.

    - Clearly identify the problem number for each solution, highlight your final answer, and answer questions in the assigned order.
- Solutions will be posted after the due date on HuskyCT. **Therefore, late homework will NOT be accepted.**

Lab Exercises:

- You will have weekly lab exercises that will entail work in the field or computer lab.
- Instructions and requirements for each lab exercise will explained in class during each lab session.
- Your weekly lab score will be based on attendance, participation, pre-lab quiz score, and field notebook submission. Field notebook specifications will be provided prior to each lab.
- Lab exercises and pre-lab quizzes will be posted to HuskyCT one week prior to your lab session. **It is your responsibility to arrive prepared to work each week.**
- See Laboratory syllabus for complete description of the lab evaluation grading component.

Semester Project:

- All students will be assigned to a geomatics team and will work together to collect, analyze and visualize data for a mapping project around an assigned campus building.
- Lab exercises are designed to provide teams with the skills needed to obtain and analyze the data required to complete the semester project. As such, your team will work to complete the project throughout the semester.
- While the semester project is a group project, each member of the team will be individually evaluated based on their performance.
- Geomatics teams will be assigned during the second week of the semester.
- The semester project consists of a series of documents: 1) mid-term assessment report, due by the end of Week 10 (see Course Schedule); 2) final report, due the last day of the semester (see Course Schedule); and 3) series of maps created using both CAD and GIS software, included as appendices to the final report.
- Instructions for the Semester Project will be posted to HuskyCT and discussed in lecture and lab.
- See Semester Project document for an overview of project goals and a complete description of project requirements.

Lab Practical:

- Active participation in lab is essential to the understanding of geomatics theory and practice. Laboratory sessions are designed to provide all students with first-hand experience using data collecting technologies (e.g., Total Station, GPS, automatic levels).
- Students will be assessed on their ability to set up and operate surveying equipment. Students will complete a two-part lab practical testing their ability to set up instrumentation and operate the equipment to collect data.
- See Laboratory Syllabus for additional information and Course Schedule for dates.

Midterm Exams:

- Two non-cumulative midterm exams will be given during the semester on **Sept. 26th** and **Oct. 24th**.
- No make-up midterms will be given, with the following exceptions: a) medical emergency with a letter from the hospital or doctor; or b) athletic team members with a letter from their coach (in case of a conflict between an exam and a tournament/meet).
- Students with a disability can contact CSD to schedule their exam in a private room with extended time.

Final Exam:

- A cumulative final exam will be given at the end of the semester during Finals week.
- This course follows all University regulations concerning the final exam: "*Final exam week for Fall 2019 takes place from Monday, December 9 through Sunday, December 15, 2019. Students are required to be available for their exam during the stated time. If you have a conflict with this time, you must visit the Dean of Students Office to discuss the possibility of rescheduling this exam. Please note that vacations, previously purchased tickets or reservations, social events, misreading the exam schedule and over-sleeping are not viable excuses for missing a final exam.*"

Course Schedule[!!]

Week	Day	Reading		Lecture Topic	Lab Topic
1	8/27		Prelim	Course overview & Introduction to Geomatics and Spatial Data Collection	Introduction to Lab & Pacing (meet in CAST 136)
	8/29	1.1-1.14, 1.20-1.21		Measuring Location: Surveys, Frames of Reference, Units of Measurement, Field Notes & Visualization	
2	9/3	3.1-3.2, 3.5-3.8, 3.18-3.22	Data Collection	Horizontal Distance Measurement	Horizontal Distance Measurement (meet in CAST 136)
	9/5	3.9-3.17 & N: 2.3-2.4[#]		HDM & Error Analysis	
3	9/10	2.1-2.7		Vertical Distance Measurement	Vertical Distance Measurement (meet in CAST 136)
	9/12	2.13-2.17		VDM & Error Analysis	
4	9/17	4.1-4.12		Measuring Angles	Total Station Basics: Angles & Distances (meet in CAST 136)
	9/19	5.1, 5.3-5.6, 5.10-5.14		Total Station	
5	9/24	6.1-6.3		Traverse: Introduction & Exam Review	Traversing I (meet in CAST 136)
	9/26			**Exam 1 (weeks 1-4)**	
6	10/1	6.4-6.7		Traverse Calculations	Traversing II (meet in CAST 136)
	10/3	6.8-6.12		Traverse Calculations	
7	10/8	N: 3.1-3.3[#]		Geo-mathematics	Determining Location with GPS (meet in CAST 136) ***Lab Practical I: Instrument Setup***
	10/10	7.1-7.5.1		GPS: Basics	
8	10/15	7.5.2-7.9		GPS: Errors and Improvements	Topographic Survey I: TS (meet in CAST 136)
	10/17	8.1, 8.5-8.7, 5.15-5.15.4		Topographic Surveys and Terrain Measurement	
9	10/22			Exam Review & Semester Project Work Session	Topographic Survey II: GPS (meet in CAST 136)
	10/24			**Exam 2 (weeks 5-8)**	
10	10/29		Data Visualization	CAD: MicroStation*	*Flex Lab* ***Lab Practical II: Measurement***
	10/31			CAD: MicroStation*	
	11/1			*Semester Project – Midterm Report***	
11	11/5	8.2-8.4 and S: pp.418-427[#]		Maps & Terrain Representation	MicroStation: Topographic Mapping (meet in CAST 117)
	11/7	10.1, 10.10 and S: pp.33-41[#]		Horizontal Control Surveys & Geographic Reference Systems	
12	11/12	7.12		Vertical Control Surveys & Geoid	MicroStation: Planimetric Mapping (meet in CAST 117)
	11/14	10.2-10.3 and S: pp.41-44[#]		Projecting Geospatial Data for Mapping and Analysis	
13	11/19	10.4-10.5 and S: pp.44-50[#]		Coordinate Systems	ArcGIS: Visualizing Geospatial Data (meet in CAST 117)
	11/21	S: pp.109-123[#]		GIS: Overview and Data Structures	
				Thanksgiving Break	
14	12/3	S: pp.158-172[#]		GIS: Analysis and Applications	ArcGIS: Creating Map Layouts (meet in CAST 117)
	12/5			Final Review & Semester Project Work Session	
	12/6			*Semester Project – Final Report***	
15		**Final Exam (cumulative)**			

!! course schedule is subject to change; changes will be announced in class and on HuskyCT
* MicroStation lectures will be presented online; there will be no in-class lectures during week 10
** no class meeting; project submission due by 5pm
[#] supplementary readings available on HuskyCT; N = Nathanson *et al*.; S = Shellito