

Applications of Surveying for Natural Resources

NRE 4544, Fall 2011

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Course Overview

Natural resource managers need to be able to create contour maps and to create planimetric maps of things like building footprints, roads, streams, vegetation transects, forest stem maps, etc. Spirit levels and total stations are two of the most important mapping tools used for this purpose.

Students will learn to set up and operate spirit levels and total stations through fieldwork exercises. Students will map portions of the UConn campus, creating topographic maps that include all the various features in the mapping area. Students will learn direct observation protocols and two indirect protocols: triangulation and trilateration. Fieldwork procedures will be covered during the lecture and demonstrated in the lab, but students should expect to perform much of the fieldwork on their own time.

Each student will perform all tasks of both surveys, meaning taking measurements, setting up reflectors and holding the stadia rods. Students will perform simple adjustments to improve their measurements and recompute closures for comparison with non-adjusted results.

Instructional Objectives

The pragmatic objective of this course is to provide the student with the scientific knowledge and technical skills to correctly produce planimetric grid coordinates using opto-mechanical instruments, like total stations.

Grading

You are required to pass the examinations, assignments, and fieldwork independently to pass the course.

2 midterm exams, 30% each	60%
Assignments	15%
Fieldwork	15%
Final examination	10%

A	B	C	D	F
(+) 99-100	(+) 87-89	(+) 77-79	(+) 67-69	< 60
93-98	83-86	73-76	63-66	
(-) 90-92	(-) 80-82	(-) 70-72	(-) 60-62	

Special Considerations

Any student who requires special arrangements in order to meet course requirements should contact the instructor to make necessary accommodations. Students should present appropriate verification from the University Program for Students with Learning Disabilities.

Reading Materials

Required: Meyer, T.H. (2010) Introduction to Geometrical and Physical Geodesy: Foundations of Geomatics, ESRI Press, 250 pp.

Lecture

Tuesday		Thursday	
30 leveling	Class overview. Units up to radians. Leveling: concept, terms: bench mark (datum surface, deep rod, concrete pillar, vertical, caps/rods), tbn (hubs), tp (nails, turtles), section, line, setup, fs/bs, linear, loop, spur, single/double run	September 1	Finish units. Equipment: types of levels, rods. 1-wire, 3-wire, computing distance (stadia). Spreadsheet
6 leveling	Field notes. Protocols: balancing fs/bs (earth's curvature, collimation error), even # of setups (eliminates rod bias), accuracy standards, minimize distance across roads	8	Computations: spreadsheet, closure, expected error, checks
13 leveling	NGVD 29, NAVD 88, data sheets, tidal datums	15	Gravity, orthometric corrections
20 topo	TS side shot equation. Linear distances: sd, hd vd. Arc distances: $d = r \theta$. Area	22	Plane angles: defn, hz, zen, aoe, bearing, az
27 Arc	Bearings to azimuths	29	Trig: sin, cos, tan, arcsin etc. Law of cosines, law of sines.
October			
4 TS	Traversing: linear, loop, field notes	6	Observation protocol: direct/inverted; close the circle
11 topo	Collimation corrections: horizontal, vertical	13	Idx: importing. Sheet 1: raw data. Sheet 2: hz angles: unpack, DMS, collimation, close circle
18	Exam I: leveling	20	No Class
25 office	Reductions: z m2m, sd m2m	27	Sheet 3: vz angles: unpack, DMS, collimation, close horizon, m2m
November			
1 TS	Sheet 4: distances: slope m2m, hd, vd	3	Inversing, map scale
8 TS	Plane traverse	10	Sheet 5: Plane traverse
15 Trav	Projection scale factor (k), grid declination	17	Exam II: plane surveying
22	Thanksgiving	24	Thanksgiving
29	Sheet 6: SPCS	1	Sheet 6: SPCS
6		8	

Lab

Tuesday	
30	LEVELING: Instr. setup, rod work, reading rods
6	Sections: K-W, W-P, P-C, C-K
13	Sections: K-W, W-P, P-C, C-K
20	Topographic mapping with levels
27	Arc
4	Total station: Instr. Setup, topo mapping
11	topo mapping
18	No class
25	Downloading and entry into Arc. Focus on data collection, understanding the total station's interface
1	Prism setup. Traversing K-P
8	Map dorms

15	Traversing K-W-P-C-K
22	Thanksgiving
29	Traversing spreadsheet
6	Traversing spreadsheet

Organization of Fieldwork

1. Leveling

a. Fieldwork

- i. Demonstrate proper observation technique
 1. Instrument setup
 2. Instrument reading
- ii. Demonstrate proper rod work
- iii. Conduct fieldwork
 1. Run levels
 - a. KCPW or KAYC
 - b. Double-run each section
- iv. submit field notes
 1. sketch
 2. observation records

b. Office work

- i. submit spreadsheet
 1. compute heights for stations
 2. compute closure, error budget

2. Total station traverse

a. fieldwork

- i. Demonstrate proper observation technique
 1. Instrument setup
 2. Instrument reading
- ii. Demonstrate proper setup for prisms
- iii. submit field notes
 1. project sketch
 2. sketch at each observation station
 3. observation records

b. office work

- i. Download observations from TS into idx file
- ii. Import idx file into spreadsheet
- iii. Decode angles into DMS and DD
- iv. Horizontal Angles
 1. Collimation correction
 - a. Average correction and stdev
 2. Close the circle
 - a. Average correction and stdev
- v. Vertical Angles
 1. Collimation correction
 - a. Average correction and stdev
 2. Close the horizon
 - a. Average correction and stdev
 3. Reduce mark-to-mark
- vi. Distances
 1. Reduce mark-to-mark
 2. Average common distances together, including reciprocal distances (e.g., KERR to ALDRICH with ALDRICH to KERR)
 3. Compute horizontal distances from averages
 4. Compute vertical distances from averages
- vii. Plane Traverse
 1. Use Y88 as POB with assumed coordinates 5000 (e) 10000 (n)
 2. Use ALDRICH for orientation; assume azimuth ALDRICH to Y88 is 270 degrees
 3. Compute coordinates for all stations
 4. Use scatter plot to draw a map

5. Compute linear misclosure for eastings, northings, total linear misclosure, total length of traverse, and ppm error.