

SURE 215: SURVEYING COMPUTATIONS



**Spring
2007/08**

Instructor: Robert Burtch

Office: Johnson Hall 304

Office Phone: 592-2634

Office Hours: M 10:00-10:50, T 3:00-
3:50, W 12:00-12:50, R
1:00-1:50

E-Mail: robert_c_burtch@ferris.edu

COURSE DESCRIPTION

- A study of principles and methods of surveying computation related to Cartesian coordinate systems, coordinate geometry including a four-parameter similarity transformation and an introduction to spherical coordinate systems as applied to spherical astronomy and the use of mathematical software with programming features.

Textbook **Surveying: Theory and Practice, 7th ed., by J. Anderson and E. Mikhail**

References **INTRODUCTION TO MATHCAD 11, by R. Larsen**



SURVEYING PRINCIPLES AND APPLICATIONS, by B. Kavanagh and S. Bird


ADVANCED SURVEYING I, by W. Faig, University of New Brunswick Lecture Note No. 26.


COURSE SCHEDULE:

- **Lecture: T 4:00-5:50, SWN 207**

- **Laboratory:**
 – Sec 211 – W 5:00-7:50



<p>Week 1 Jan 4 - Jan 18</p> 	<p>Introduction: Understand course objectives, grading policy, etc. Traverse Computations including computation of angular error of closure, compute azimuths from angle, Compute latitudes and departures, linear error and its direction and relative error of closure, adjustment of the traverse by Compass and Transit Rules, compute final adjusted traverse</p>
<p>Week 2 Jan 21 - Jan 25 (No class 1/21)</p>	<p>Traverse Computations - compute coordinates of traverse points and determination of area by DMD and coordinates</p>

Week 3 Jan 28 - Feb 1	Coordinate Geometry: Equation of a line, equation of circle, solving equations simultaneously, quadratic equation
Week 4 Feb 4- Feb 8	Coordinate Geometry: Line-line intersection
Week 5 Feb 11 - Feb 15	Horizontal and Vertical curves 
Week 6 Feb 18 - Feb 22	Coordinate Geometry: Line-circle intersection

Week 7 Feb 25 - Feb 29	Coordinate Geometry: Circle-circle intersection
Week 8 Mar 3 - Mar 7	Coordinate Geometry: Missing data calculations
Mar 10 - Mar 14	Spring Break
Week 9 Mar 17 - Mar 21 (No Classes Mar 20-21)	Coordinate Geometry: Area Partitioning
Week 10 Mar 24 - Mar 28	Coordinate Geometry: Three point resection

Week 11 Mar 31 – Apr 4	Coordinate transformation
Week 12 Apr 7 - Apr 11	Spherical Astronomy: Basic spherical astronomy concepts and definitions, coordinate systems
Week 13 Apr 14 - Apr 18	Spherical Astronomy: Corrections to astronomical observations
Week 14 Apr 21 – Apr 25	Spherical Astronomy: Azimuth using Polaris observations and observations on the sun
Week 15 Apr 28 – May 2	Spherical Astronomy
Week 16	Final Exam: Tuesday, May 6, 4:00 – 5:40

LAB WORK



- In labs, the student will be introduced to computer methods of solving surveying problems. Topics will include: Introduction to Mathcad fundamentals including kinds of equal signs, entering an equation, working with units, and manipulating displays; Mathcad functions: elementary mathematical functions, trigonometric functions, logical functions, string functions, file functions; Mathcad: working with arrays, graphing capabilities

LAB WORK

- All work will be due on the date specified
- Late assignments will be assessed a penalty of 5% per day or fraction thereof
- All work must be completed to receive a passing grade for this course
- No assignments will be accepted after the unit exam in which the assignment was given
- Each assignment will be submitted in a report folder that can be reused throughout the semester.

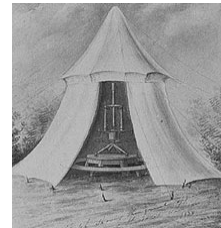


LAB WORK

- A cover sheet will be included with each assignment identifying the assignment, student name, and class
- Unless otherwise stated, only one assignment per folder will be accepted
- All work must be completed in pencil on engineering paper
- All formulas must be shown and identified
- All figures shall be drawn with a straight edge and appropriate templates
- All parts of graphic will be labeled

LAB WORK

- Use only the front side of the sheet. Always include units in the answer and highlight the answer by either underlining it, placing a box around the answer, or by using a highlighter. When you have answers that are less than 1, always begin the number with a zero. For example, .471 shall be written as 0.471. When writing angles, minutes and seconds must always have two units, excluding any decimal portion. If a minute or second contains only single units, i.e., 4 minutes, 7 seconds, the number shall be preceded by a zero. In this case, 04' 07". Unless otherwise stated, all angles will be presented in degrees, minutes and seconds format. Use common sense in portrayal of significant figures.



LINE-LINE INTERSECTION

PT. No.	X	Y	NAME
1	895.03'	1426.51'	
2	1744.09'	1701.59'	

ANGLE 2-1-3: $\alpha = 67^{\circ} 35' 15''$
 1-2-3: $\beta = 85^{\circ} 15' 35''$

SOLUTION:

1) COMPUTE AZIMUTH AND DISTANCE OF LINE 1-2 AND ANGLE AT P13

$$Az_{12} = \tan^{-1} \left[\frac{Y_2 - Y_1}{X_2 - X_1} \right] = 72^{\circ} 02' 55''$$

$$D_{12} = \sqrt{(X_2 - X_1)^2 + (Y_2 - Y_1)^2} = 892.509'$$

$$\gamma_3 = 180^{\circ} - (\alpha + \beta) = 30^{\circ} 09' 10''$$

2) FROM SINE LAW, COMPUTE D_{13} & THEN AZIMUTH, Az_{13}

$$D_{13} = \frac{D_{12}}{\sin \gamma_3} \sin \beta = 1760.629'$$

$$Az_{13} = Az_{12} + \alpha = 139^{\circ} 38' 10''$$

These functions take an angle in DD/MMSSss format, converts to decimal degrees (function dd) and into radians (function radians). The function dms converts an angle in decimal degrees to DD.MMSSss format.

$$dd(ang) := \begin{cases} degree \leftarrow floor(ang) \\ minutes \leftarrow (ang - degree) \cdot 100.0 \\ minutes \leftarrow floor(minutes) \\ seconds \leftarrow (minutes - floor(minutes)) \cdot 100.0 \\ degree + \frac{minutes}{60.0} + \frac{seconds}{3600.0} \end{cases}$$

$$radians(ang) := \begin{cases} d \leftarrow dd(ang) \\ d \cdot \frac{\pi}{180.0} \end{cases}$$

$$dms(ang) := \begin{cases} degree \leftarrow floor(ang) \\ rem \leftarrow (ang - degree) \cdot 60 \\ minutes \leftarrow floor(rem) \\ rem1 \leftarrow (rem - minutes) \\ secs \leftarrow rem1 \cdot 60.0 \\ degree + \frac{minutes}{100} + \frac{secs}{10000} \end{cases}$$

$$todeg := \frac{180.0}{\pi} \quad \text{todeg is the factor to convert radians into degrees}$$

Given:

$\alpha_{dms} := 67.3515$	$\beta_{dms} := 82.1535$	α and β in DD.MMSSss format
$\alpha := radians(\alpha_{dms})$	$\beta := radians(\beta_{dms})$	Convert angles to radians
$\alpha = 1.17962$	$\beta = 1.4357$	
$X_1 := 895.03$	$X_2 := 1744.09$	Given coordinates of the ends of line 1-2
$Y_1 := 1426.51$	$Y_2 := 1701.59$	

Solution:

Compute the azimuth and distance of line 1-2 and the angle at point 3.

$$Az_{12} := atan2[(Y_2 - Y_1), (X_2 - X_1)] \quad dms(Az_{12}, todeg) = 72.0255$$

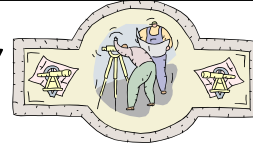
$$D_{12} := \sqrt{(X_2 - X_1)^2 + (Y_2 - Y_1)^2} \quad D_{12} = 892.50876$$

$$Ang_3 := \pi - (\alpha + \beta) \quad dms(Ang_3, todeg) = 30.091$$

ATTENDANCE POLICY

- Each student will be allowed to miss up to 4 classes, either lectures or lab, without penalty
 - These absences may be for any reason and do not require giving me an excuse
 - A student who is absent a fifth time will be required to withdraw from the course if this absence occurs during the withdrawal period of the semester
 - If this absence occurs after the withdrawal period the student will receive a failing (F) grade in the course.

ATTENDANCE POLICY



- Exceptions to the Attendance Policy (Verification of all exceptions is necessary):
 - A University-sponsored event in which an excused absence from the Vice President for Academic Affairs office is given.
 - Death of a family member or close personal relation (friends, neighbors).
 - Extended hospitalization (this does not apply to a visit to the health center because of a cold or other illness).
 - Jury duty or being subpoenaed to testify in a court case.
 - Dangerous weather conditions in which driving is considered by local authorities to be unsafe (for commuter students).

CLASS CONDUCT

- Class starts on the hour so please make every effort to arrive on time by planning ahead for any contingencies.
- Class lasts for 50 minutes so do not begin to pack up your books and other items early. This is very distracting to me and your fellow students. You are expected to participate throughout the entire class period.
- Turn off all cell phones, pagers, pda's and other electronic devices before class. If there are extenuating reasons, please see me.
- During the lecture, feel free to ask questions, but refrain from conducting personal conversations. Again, this is very disruptive.
- When you leave the classroom, please pick up after yourself. Try to leave the room cleaner than when you found it.

CLASS CONDUCT

- Sleeping, eating and reading newspapers are not allowed in class. While in class the student is expected to pay attention and participate in this class and not finish work for another class during this class periods.
- Come to class prepared. Instructional material students should not be without include, as a minimum, writing material, computer disks and calculators.
- Students are expected to check the web page for this course weekly and students are responsible for all material on this web page along with textbook and other readings.

PERFORMANCE CRITERIA/ GRADING

50% from exams
50% from laboratory and other
100% TOTAL

90 - 100% - A Range
80 - 89% - B Range
70 - 79% - C Range
60 - 69% - D Range
0 - 59% - F Range

