SUR3520 Measurement Science
SUR5525 Least Squares Adjustment

OVERVIEW

Measurement science presents methodologies for analyzing and handling errors with a focus on least squares adjustments. This course will provide students with a thorough understanding of errors in geodetic measurements, their sources, and magnitudes. Students will learn related concepts covering the theory of errors, statistical distributions, hypothesis testing, law of error propagation on various types of observations, principle of least squares, adjustment procedures (e.g., horizontal surveys, level networks, GPS baselines), and error ellipses.

- Spring semester, 3 credits
- 100% online, synchronous and asynchronous component
- http://elearning.ufl.edu/

Course Prerequisites: MAC 2233, STA 2023, and SUR 3641 Survey Computations, or instructor consent

Instructor:
Dr. Hartwig Henry Hochmair, Ft. Lauderdale Research & Education Center, Davie West Bldg.
phone: (954) 577-6317; e-mail: hhhochmair@ufl.edu

Teaching assistant:
Adam Benjamin, Ft. Lauderdale Research & Education Center, Davie West Bldg.
phone: (954) 577-6378; e-mail: abenjamin1@ufl.edu

- Please use the Canvas message/Inbox feature for fastest response.
- Students are also welcome to arrange a video conference meeting to go over any questions.

Lectures:
Tue: 10:40a-11:30a (period 4), Thu: 10:40a-12:35p (period 4+5) via Zoom
Note: Most lectures are prerecorded. Links to lecture recordings will be posted on Canvas in weekly modules.
First day of class: 01/08/19. Last day of class: 04/23/19

Recommended textbook:

- Ghilani, C. D. (2018). Adjustment Computations - Spatial Data Analysis (6th Ed.). New York, NY: John Wiley & Sons
- Additional reading material for each session will be made available in advance through the Canvas course Web site (http://elearning.ufl.edu/)

LEARNING OUTCOMES

The course objective is to provide students with (a) a thorough understanding of errors, their sources, and magnitudes, and (b) skills to account for the presence of errors in spatial data handling.
At the completion of the course, the student should be able to:

- apply methods of statistics to assess and describe the quality of measurements
- apply the theory of error propagation and least-squares method to geodetic observations
- describe the effect of errors on geodetic observations
- use error ellipses for geodetic network design
- use adjustment software and spread sheet functions for adjustment computations
- demonstrate written communication skills in interpreting computational results

COURSE LOGISTICS

- Throughout the semester, students will be given homework assignments (around 9), quizzes (around 4), and discussion tasks (around 4).

- For each assignment, a due date and time is given.
- Discussion boards will be graded based on quality and completeness.
- This course is a distance education course taught partly as prerecorded lectures and partly as live lectures using the virtual classroom software Zoom.
- Lecture materials can be downloaded from the Canvas website.
- The Canvas system should be used as the platform for written communication between students and the instructor.
- Questions and suggestions to the whole class can also be posted under the Discussions tab.
- Any short-term changes concerning lectures or other course components will be announced through Canvas.
- Feel free to call the instructors with any questions.

Technology Requirements:

- A computer or mobile device with high-speed internet connection
- A headset and/or microphone and speakers; a web cam is suggested
- A Web browser with the latest updates for Zoom

Using Zoom:
Live lectures (as announced) and office hour meetings (per individual student requests) will be conducted with the Zoom web conferencing software. Sessions can be joined by clicking a link posted by the instructor on Canvas. Zoom only requires an internet connection and a web browser. More details can be found here.

GRADING:
In order to give you more control over your education, you may select the weight of each assessment category as a percentage of your semester grade from the ranges provided in the table below:

Grading items:

Item	*Percentage*
Homework assignments	28-34%
Online quizzes and discussions	8-12%
Attendance of Q/A sessions and guest lectures	3-7%
Midterm exam	20-24%
Field Lab	8-12%
Final exam (cumulative)	20-24%
Total	**100%**

If you choose to, you need to submit your grading plan by Tue February 12. For this purpose a “quiz” will be set up in Canvas, where you can enter your preferred weighting options. By that time you will have seen examples from each type of assessment except for exams and field lab. If you don’t submit your grading plan, or if the one you submit doesn’t add up to 100%, then the midpoint of each range will be used.

Grading scale:

Grade	*Percentage*	*Grade*	*Percentage*
A	90.0-100.0	C+	73.0-74.9
A-	87.0-89.9	C	67.0-72.9
B+	85.0-86.9	C-	65.0-66.9
B	77.0-84.9	D	50.0-64.9
B-	75.0-76.9	E	0-49.9

Graduate students are required to complete an additional assignment that consists of advanced tasks relating to topics taught throughout the semester. Completing the tasks requires adjustment computations that are not part of other

assignments. The additional assignment counts towards the homework assignment grade. A minimum point score is not required on the additional assignment to receive a final course grade.

For information on current UF policies for assigning grade points, see
https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

COURSE CONTENT

Week	Topic	Book chapter
Week 1, Jan 8	Course introduction Types of measurements and errors	 ch. 1
Week 2, Jan 15	Analyzing measurements Random errors	ch. 2 ch. 3
Week 3, Jan 22	Distributions used in sampling theory Confidence intervals	ch. 4
Week 4, Jan 29	Hypothesis testing	ch. 5
Week 5, Feb 5	Law of error propagation	ch. 6
Week 6, Feb 12	Error Propagation in distance, angle, and elevation measurements	ch. 7-9
Week 7, Feb 19	Exam review Q & A (2/21) – *attend. req'd* Principles of Least Squares Adjustment	 ch. 11
Week 8, Feb 26	**Feb 28: Midterm exam**	
Week 9	*Mar 4 - Mar 8: Spring Break*	
Week 10, Mar 12	Solving nonlinear equation systems	ch. 11
Week 11, Mar 19	Adjustment of level networks	ch. 12
Week 12, Mar 26	Adjustment of trilateration networks	ch. 14
Week 13, Apr 2	Adjustment of triangulation networks Error ellipse	ch. 15 ch. 19
Week 14, Apr 9	Adjustment of GNSS baselines	ch.17
Week 15, Apr 16	Exam review Q & A (4/16) – *attend. req'd* Guest lecture (4/18) – *attend. req'd*	ch. 21
Week 16, Apr 23	No lecture. Finish field lab	
Week 17	**Apr 30: Final exam**	

EXAM DATES

- Midterm exam: Thursday 2/28 from 10:40a - 12:35p
- Final exam: Tuesday 4/30 from 12:30p – 2:30p

OTHER DATES WITH ATTENDANCE REQUIRED

- 2/21, 10:40a: Mid-term exam review Q & A session
- 4/16, 10:40a: Final exam review Q & A session
- 4/18, 10:40a: Guest lecture

POLICIES

This syllabus represents current plans and objectives for this course. As the semester progresses, changes may need to be made to accommodate timing, logistics, or to enhance learning. Such changes, communicated clearly, are not

unusual and should be expected.

Late submissions and make-up requests:
It is the responsibility of the student to access on-line lectures, readings, quizzes, and exams and to maintain satisfactory progress in the course.

- A 10% penalty per day will be applied to late assignments. A late submission on the due date also results in a 10% deduction.
- Assignments will not be accepted if handed in more than a week after the due date.
- Quizzes and discussion assignments cannot be completed past the deadline.
- Exceptions to the late policy are only allowed per university policy.

Computer or other hardware failures, except failure of the UF e-Learning system, will not excuse students for missing assignments. Any late submissions due to technical issues MUST be accompanied by the ticket number received from the Helpdesk when the problem was reported to them. The ticket number will document the time and date of the problem. You MUST e-mail your instructor within 24 hours of the technical difficulty if you wish to request consideration. For computer, software compatibility, or access problems call the HELP DESK phone number—352-392-HELP = 352- 392-4357 (option 2).

Requirements for class attendance and make-up exams, assignments and other work are consistent with university policies that can be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx.

Semester Evaluation Process:
Student assessment of instruction is an important part of efforts to improve teaching and learning.

- At approximately the mid-point of the semester, the School of Forest Resources & Conservation will request anonymous feedback on student satisfaction on various aspects of this course. These surveys will be sent out through Canvas and are not required, but encouraged. This is not the UF Faculty Evaluation!
- At the end of the semester, students are expected to provide UF with feedback on the quality of instruction in this course using a standard set of university and college criteria (UF Faculty Evaluations). These evaluations are conducted online at https://evaluations.ufl.edu. Evaluations are typically open for students to complete during the last two or three weeks of the semester; students will be notified of the specific times when they are open. Summary results of these assessments are available to students at https://evaluations.ufl.edu/results.

Netiquette: Communication Courtesy Semester Evaluation Process:
All members of the class are expected to follow rules of common courtesy in all email messages, threaded discussions and chats. Failure to do so may result in loss of participation points and/or referral to the Dean of Students' Office. http://teach.ufl.edu/docs/NetiquetteGuideforOnlineCourses.pdfStudent

Academic Honesty Policy:
As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: "*We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity*."

You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied: "*On my honor, I have neither given nor received unauthorized aid in doing this assignment*."

It is assumed that you will complete all work independently in each course unless them instructor provides explicit permission for you to collaborate on course tasks (e.g. assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct or appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated.

Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For more information

regarding the Student Honor Code, please see: http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code

University Policy on Accommodating Students with Disabilities:
Students requesting accommodation for disabilities must first register with the Dean of Students Office (http://www.dso.ufl.edu/drc/). The Dean of Students Office will provide documentation to the student who must then provide this documentation to the instructor when requesting accommodation. You must submit this documentation prior to submitting assignments or taking the quizzes or exams. Accommodations are not retroactive, therefore, students should contact the office as soon as possible in the term for which they are seeking accommodations.

Software use:
All faculty, staff and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate.

GETTING HELP
For issues with technical difficulties for e-learning in Canvas, please post your question to the Technical Help Discussion in your course, or contact the UF Help Desk at:

- Learning-support@ufl.edu | (352) 392-HELP - select option 2 | http://elearning.ufl.edu
- Library Help Desk support http://cms.uflib.ufl.edu/ask
- SFRC Academic Hub https://ufl.instructure.com/courses/303721

Student Life, Wellness, and Counseling Help:

- Counseling and Wellness resources http://www.counseling.ufl.edu/cwc/
- U Matter, We Care http://www.umatter.ufl.edu/
- Career Resource Center http://www.crc.ufl.edu/
- Other resources are available at http://www.distance.ufl.edu/getting-help for online students

Student Complaint Process:
The School of Forest Resources & Conservation cares about your experience and we will make every effort to address course concerns. We request that all of our online students complete a course satisfaction survey each semester, which is a time for you to voice your thoughts on how your course is being delivered.
If you have a more urgent concern, your first point of contact should be the SFRC Academic Coordinator or the Graduate/Undergraduate Coordinator for the program offering the course. You may also submit a complaint directly to UF administration:

- Students in online courses: http://www.distance.ufl.edu/student-complaint-process
- Students in face-to-face courses: https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf