

SUR3520 Measurement Science SUR5525 Least Squares Adjustment

1. 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

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- Please use the Canvas message/Inbox feature for fastest response
- Virtual office hours by appointment

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Lectures:

Tuesdays: 10:40a-11:30a (period 4), Thursdays: 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: 01/07/20. Last day of class: 04/21/20

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/>)

Software requirements:

- Microsoft Excel will be the primary software used for most topics in this course.
- Geodetic software (ADJUST and StarNet) will be used for selected adjustment topics. Software download instructions for this software will be provided on the course website under the Week 7 and Week 11 module, respectively.

2. LEARNING OUTCOMES

The course objective is to provide students with the following competencies at the completion of the course:

1. apply statistical methods to describe the distribution and quality of geodetic measurements
2. use error propagation to model the error of indirect measurements
3. apply the least-squares method to adjust various types of measurements using geodetic software and spread sheet functions
4. use error ellipses for geodetic network design

5. provide an interpretation of computational results and communicate them effectively

3. COURSE LOGISTICS

- Throughout the semester, students will be given 10 homework assignments (graduate students: 11), 3 quizzes, 6 discussion tasks, and one field lab assignment.
- For each assignment, a due date and time is given which is usually midnight one week after the handout
- Assignments and field labs are graded based on timeliness, correctness of computations and interpretation of numerical results, with written feedback provided by the instructor; quizzes are auto-graded based on correctness of multiple choice questions with correct answers shown after completion, and discussion items are graded within a week based on creativity, completeness, technical correctness and the number of comments provided to peers.
- There is a 1-week turnaround for assignment, field lab, and discussion grading. Quizzes are autograded instantaneously in Canvas.
- 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 weekly modules on the Canvas website.

Technology Requirements:

- A computer or mobile device with high-speed internet connection
- A headset and/or microphone and speakers to participate in live sessions
- For Zoom: A supported web browser on a supported operating system (Windows, Mac OS, Linux); and minimum bandwidth. More details can be found [here](#).

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.

Grades:

In order to give students more control over their education, the class is invited to select the weight of each assessment category as a percentage of the semester grade from the ranges provided in the table below:

<i>Item</i>	<i>Percentage</i>
Homework assignments	28-34%
Quizzes	6-10%
Online discussions	4-6%
Attendance of Q/A sessions	3-5%
Exams (mid-term + final)	40-48%
Field Lab	6-10%
Total (mid-points)	100%

For this purpose a “quiz” (not graded) will be set up in Canvas, where each student can enter the preferred weighting options by Feb 11. By that date, examples from each type of assessment (except for exams and field lab) will have been given as assignments. From all submitted quiz responses, the average percentage value will be computed for each category and used for grading.

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>

4. COURSE CONTENT

Week	Topic	Book chapter
Week 1, Jan 7	Course introduction Types of measurements and errors	ch. 1
Week 2, Jan 14	Analyzing measurements Random errors	ch. 2 ch. 3
Week 3, Jan 21	Distributions used in sampling theory Confidence intervals	ch. 4
Week 4, Jan 28	Hypothesis testing	ch. 5
Week 5, Feb 4	Law of error propagation	ch. 6
Week 6, Feb 11	Error Propagation in distance, angle, and elevation measurements	ch. 7-9
Week 7, Feb 18	Exam review Q & A (2/20) – <i>attend. req'd</i> Principles of Least Squares Adjustment	ch. 11
Week 8, Feb 25	Feb 27: Midterm exam	
<i>Week 9</i>	<i>Mar 2 - Mar 6: Spring Break</i>	
Week 10, Mar 10	Solving nonlinear equation systems	ch. 11
Week 11, Mar 17	Adjustment of level networks	ch. 12
Week 12, Mar 24	Adjustment of trilateration networks	ch. 14
Week 13, Mar 31	Adjustment of triangulation networks Error ellipse	ch. 15 ch. 19
Week 14, Apr 7	Adjustment of GNSS baselines	ch.17
Week 15, Apr 14	Exam review Q & A (4/16) – <i>attend. req'd</i>	ch. 21
Week 16, Apr 21	No lecture. Finish field lab	
Week 17	Apr 28: Final exam	

Exam dates:

- Midterm exam: Thursday 2/27 from 10:40a - 12:35p
- Final exam: Tuesday 4/28 from 10:00a – 12:00p

Other dates with attendance required:

- 2/20, 10:40a: Mid-term exam review Q & A session
- 4/16, 10:40a: Final exam review Q & A session

Note: If a student cannot attend a class with live attendance required for a justified reason (e.g. job related), the student needs to let the instructor know in advance, and an alternative assignment is given instead to avoid loss of points.

5. POLICIES AND REQUIREMENTS

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 (unless specified differently).
- Quizzes cannot be taken past the deadline
- Online discussions 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 professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-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, as laid out in the [UF Netiquette Guide](#) for Online Courses. Failure to do so may result in loss of participation points and/or referral to the Dean of Students' Office.

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 the 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> View [this video](#) for more information on how to avoid plagiarism.

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.

6. 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>

For any other questions related to the course, please do not hesitate to contact the instructor or teaching assistant. Each home assignment will be accompanied by a discussion board on Canvas where students can discuss questions on given assignment tasks with each other.

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