

MECH 5970/6970: Fundamentals of GPS Navigation
Spring 2023
Lowder 26, MW 3:00-4:15 (make-ups on F 3:00-4:15)

Instructor: Dr. David M. Bevly

Phone: 844-3446

Office Hours: MW 9-10, 11:30-12, 2-3, 4:30-5:30

Class Website: http://eng.auburn.edu/~dmbevly/fund_gps/

Textbook: P. Misra, P. Enge, *Global Positioning System: Signals, Measurements, and Performance*, Revised 2nd Edition, Ganga-Jamuna Press, Lincoln, MA, 2011.

Supplemental References:

Kai Bore, Dennis M. Akos, et.al., "A software-defined GPS and Galileo Receiver: A single frequency approach," Birkhauser, Boston, MA, 2007

Parkinson, Bradford W. and James J. Spilker Jr. "Global Positioning System: Theory and Applications." Vols 1&2. Progress in Astronautics and Aeronautics. AIAA, 1996.

Kaplan, Elliott D. "Understanding GPS: Principles and Applications," Artech House, 1996.

Hofmann-Wellenhof, B., H. Lichtenegger, and J. Collins. "GPS Theory and Practice." Fifth revised edition. Springer, 2004.

Beginning MATLAB for Engineers, S. J. Reeves, College House Enterprises, LLC, 2001, 20 pp.

Matlab Help located at:

http://www.eng.auburn.edu/departments/ee/pages/comp_tools.html

Pre-Requisites: MECH3140 or ELEC3500

Strongly Recommended Pre-Requisite: Statistics, Matlab, MECH3140

Grading Policy:

1.	Exam (most likely on-line)	25
2.	Homework	25
3.	Lab Assignments	25
4.	Final Project	25
Total		100

Scale:

90-100 - A	70-79 - C
80-89 - B	60-69 - D
Below 60 - F	

Final Project Presentations: May 5th (Friday) from 1:30-3:30 pm (Final Exam Slot)

Tentative Lecture Topic Outline (Subject to Change):

<u>Week</u>	<u>Topic</u>
1	Introduction to Various Navigation Technologies
2	GPS Overview & Coordinate Systems
3	Trilateration and Least Squares Best Fit
4	PVT Calculation
5	Satellite Orbits
6	GPS Operation and signal structure
7	Differential GPS
8	Receiver Hardware
9	GPS Signal Tracking (Phase Lock Loops)
10	GPS Code Tracking (Delay Lock Loops)
11	Math and Statistics for GPS Signal Processing
12	Satellite Tracking
13	Ephemeris Decoding
14	Navigation Decoding
15	Advanced GPS Techniques and Integration with IMUs

Lab Assignments:

This course will include several laboratory assignments which will consist of GPS data collection and analysis.

5970/6970 Variation

Those enrolled in 5970 (primarily undergraduates) may be given sample (“starter”) code for several assignments. It is anticipated those enrolled in 6970 (primarily graduate students) will write/develop all of their software from scratch. Additionally, some problems may be optional for 5970, but required for 6970.

General Policies

Class attendance is expected but not *formally* recorded. Late submission of assigned work or make-up examinations will be allowed if and only if accompanied by an approved University excuse. Additionally, I expect a very high standard of honesty among students at Auburn University as I feel that engineers with moral integrity is of the utmost importance in society. Because of the importance of academic honesty to the reputation of Auburn Engineers, I will report violations of academic honesty as outlined in the Auburn Tiger Cub.

Accessibility

It is the policy of Auburn University to provide accessibility to its programs and activities, and reasonable accommodations for persons defined as having a disability under Section 504 of the rehabilitation Act of 1973, as amended, and the Americans with Disabilities Act of 1990. Students who need special accommodations should make an appointment to see the instructor as soon as possible or contact The Student with Disabilities Program office at (334) 844-5943 (Voice/TT)

Instruction, Office Hours, and COVID-19

As we return to campus this fall, our classroom will be altered in planned and unplanned ways. It is our strong commitment to maintain the quality of instruction and the quality of the learning environment. To this end, I plan to present lectures for this section in person. I may try to record lectures in case any students are having to quarantine (but I make not promises or guarantees on the quality of the recording). Additionally no quizzes or exams will be allowed to be taken remotely. In the event that I am unable to come to class (I have scheduled travel days already planned), I will have a substitute present lectures or may post lectures to the class website and may hold a zoom discussion of the lecture or discuss the lecture during the next class period. Should I be unable to lecture for an extended period (say 10 days), we may have to rely on another faculty's lectures during that period.

Due to unforeseen circumstances or changes in university guidance, the syllabus and course is subject to change, and you will be notified as soon as possible to any changes to the course syllabus.

Assignment Submissions

All assignments will be submitted in class (or via Canvas as a ***SINGLE PDF File*** if in-class instruction changes). Failure to submit work as a single file will result in the submission not being graded. There are several applications for smartphones such as "CamScanner" to accomplish this. You should also be wary of file size to facilitate uploading.

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Face Coverings and Social Distancing

This class will adhere to the guidelines documented in *A Healthier U – Comprehensive Health and Safety Plan*. All students should read, become familiar with, and follow the guidelines in this safety plan: <http://ahealthieru.auburn.edu/>.

While students, faculty and staff are expected to follow all the guidelines, the following items emphasize expectations for in-person instruction and interactions:

- Students, faculty, and staff will use the STAY SAFE TOGETHER™ platform.
- Students, faculty, and staff will wear face coverings at all times when inside classrooms, laboratories, and any university buildings when in the presence of others. Face coverings must also be worn outdoors on campus when appropriate physical distancing is impractical or impossible. Face coverings must be worn properly (i.e., completely covering nose and mouth) at all times. Anyone not adhering to proper face coverings will be required to leave immediately.
- Students, faculty, and staff will practice social distancing when meeting in person. Though *A Healthier U* states that social distancing will be achieved by limiting classrooms to 50% capacity, it will be maintained in this class with a minimum of 6 feet between people. Anyone not adhering to proper social distancing will be required to leave the building immediately.

Noncompliance with these policies will be considered a violation of the AU Policy on Classroom Behavior. The offending student(s) will be charged in accordance with the AU Code of Student Conduct. Please note that *A Healthier U* may be updated, or additional guidance developed, as conditions change. This class will adhere to the latest guidance as it becomes available.