Data Measurement and Analysis

EGM 5121C Sections 25851, 25542
Class Periods: Days of week, period, and corresponding time of day
Location: Online
Academic Term: Spring 2021

Instructor:
Thomas E. Angelini
t.e.angelini@ufl.edu
352-392-6438
Office Hours: 9:30am Monday / 10:30am Wednesday (Zoom meeting ID: 927 6155 1598).

Teaching Assistant/Peer Mentor/Supervised Teaching Student:
Please contact through the Canvas website

- TBA

Course Description
Tools for random data analysis (including types of random data, mean values, mean-square values, probability density and distribution functions, moments and characteristic functions, and spectral and correlation analysis); bias and random error estimates in data measurements; input-output system models; and measurement examples. (3 credit hours)

Course Pre-Requisites / Co-Requisites
NA

Course Objectives
The objective of this course is to survey the most commonly used tools of data analysis, achieving a basic understanding of their fundamental foundations and becoming facile with their application. Students will explore statistical functions (e.g., probability density functions, moments, etc.), time-domain (e.g., auto- and cross-correlation) functions, and frequency-domain (e.g., auto- and cross-spectra) methods and apply them to practical engineering problems.

Materials and Supply Fees
NA

Required Textbooks and Software
NA

Recommended Materials
1. Textbook: Random Data: Analysis and Measurement, Julius S. Bendat Allan G. Piersol, any edition.
2. Textbook: Physical Models of Living Systems, Philip Nelson, any edition.
3. MATLAB software

Course Schedule

Date	Topic	Reading
Tuesday, January 12, 2021	Syllabus, Semester Schedule, Intro	Ch1
Tuesday, January 12, 2021	Intro	Ch1
Thursday, January 14, 2021	Intro	Ch1
Tuesday, January 19, 2021	Linear Response 1	Ch2
Tuesday, January 19, 2021	Linear Response 2	Ch2
Thursday, January 21, 2021	Ex: Viscoelasticity	
Tuesday, January 26, 2021	EX: Maxwell Materials	
Tuesday, January 26, 2021	**Exam 1**	
Thursday, January 28, 2021	Intro to Probability	Ch3
Tuesday, February 2, 2021	Working with PDFs	Ch3
Tuesday, February 2, 2021	Chebyshev's inequality	Ch3
Thursday, February 4, 2021	Probability of multiple variables	Ch3
Tuesday, February 9, 2021	Two gaussian random variables	Ch3
Tuesday, February 9, 2021	Change of Variables and ln PDFs	Ch3
Thursday, February 11, 2021	High order COV and the Jacobian	Ch3
Tuesday, February 16, 2021	The Central Limit Theorem	Ch3
Tuesday, February 16, 2021	Selected distributions and their properties	
Thursday, February 18, 2021	Selected distributions and their properties	
Tuesday, February 23, 2021	**Exam 2**	
Tuesday, February 23, 2021	Intro to stationary random processes	Ch5
Thursday, February 25, 2021	Recharge Day	
Tuesday, March 2, 2021	Convolution, Correlation, Covariance	Ch5
Tuesday, March 2, 2021	Properties of the Correlation Function	Ch5
Thursday, March 4, 2021	Autospectral density functions	Ch5
Tuesday, March 9, 2021	Relation between SDF and Corr. Fun.	Ch5
Tuesday, March 9, 2021	Distinguishing lineshapes without fitting	
Thursday, March 11, 2021	Digital Fourier Space in MATLAB	
Tuesday, March 16, 2021	Cross Correlation Functions	Ch5
Tuesday, March 16, 2021	Cross Spectral Density Functions	Ch5
Thursday, March 18, 2021	Ex: Spatial correlations	
Tuesday, March 23, 2021	Propagation of Errors and Uncertainties	Ch8
Tuesday, March 23, 2021	Statistical Errors in Basic Estimates	Ch8
Thursday, March 25, 2021	Confidence intervals on single measurements	Ch8
Tuesday, March 30, 2021	Confidence intervals on statistical averages	Ch8
Tuesday, March 30, 2021	Errors on estimates with noise	Ch8
Thursday, April 1, 2021	**Exam 3**	
Tuesday, April 6, 2021	Application: image thresholding by covariance maximization	
Tuesday, April 6, 2021	Application: programming PIV/DIC in MATLAB	
Thursday, April 8, 2021	Application: intensity moments analysis in MATLAB	
Tuesday, April 13, 2021	Application: Space-time correlations in v-fields	
Tuesday, April 13, 2021	Application: Static scattering methods	
Thursday, April 15, 2021	Application: Dynamic scattering and spectral methods	
Tuesday, April 20, 2021	Application: STORM and PALM imaging	
Tuesday, April 20, 2021	Application: STORM and PALM imaging	
Thursday, April 29, 2021	Final Exam, 7:30 - 9:30 am	

Online Course Recording
Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

Attendance Policy, Class Expectations, and Make-Up Policy

Class policies

- Cheating or any other dishonesty will result in failure and prosecution according to university policies. ASME has a website dedicated to engineering ethics, http://www.asme.org/ethics/.
- Students are responsible for all announcements, assignments, etc. made during lectures, including changes in the scheduling of lecture topics, assignments, and exams.
- **This is an all-online course**. All lectures will be recorded and available on the course Canvas page immediately following the scheduled class time. **Office hours attendance is highly recommended.**
- For exams and assignments, late submissions will be allowed for documented medical reasons, UF related travel or job interview travel. Excused absences must be in compliance with university policies in the Graduate Catalog (http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#attendance) and require appropriate documentation.
- Any changes in the schedule or assignments will be communicated to the class via email using your Gatorlink (@ufl.edu) email address or using the course CANVAS site. You are responsible for monitoring this mailbox and the web site regularly for any class notices.

Exam policies

- There will be three exams and one final exam this semester to determine your grade. All exams will be take-home.
- It is the students' responsibility to communicate their knowledge on the exams. In order to be able to grade your work, it must be neat, legible, and follow in logical steps with all work shown. *Partial credit* may be given for work which can be followed and the nature and magnitude of the mistake identified. *No credit* will be given for incorrect answers with insufficient indication of how they were obtained.

Evaluation of Grades

Exams I-III, Final determine 100% of your grade

Grading Policy

To determine your course grade, the four exam scores will be averaged and rounded to the nearest whole number. Each exam score may be curved depending on the degree of difficulty and the overall class performance. We will follow the following grading scale.

Percent	Grade	Grade Points
94 - 100	A	4.00
90 - 93	A-	3.67
87 - 89	B+	3.33
83 – 86	B	3.00
80 - 82	B-	2.67
77 - 79	C+	2.33
73 – 76	C	2.00
70 - 72	C-	1.67

67 - 69	D+	1.33
63 - 66	D	1.00
60 - 62	D-	0.67
0 - 59	E	0.00

More information on UF grading policy may be found at:
http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades

Students Requiring Accommodations
Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting https://disability.ufl.edu/students/get-started/. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation
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/.

University Honesty Policy
UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students 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." The Honor Code (https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment
The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:
• Your academic advisor or Graduate Program Coordinator
• Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu
• Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
• Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

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. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy
There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: https://registrar.ufl.edu/ferpa.html

Campus Resources:

Health and Wellness

U Matter, We Care:
Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: http://www.counseling.ufl.edu/cwc, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence
If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)
Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or http://www.police.ufl.edu/.

Academic Resources

E-learning technical suppor*t*, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. https://www.crc.ufl.edu/.

Library Support, http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/.

Writing Studio, 302 Tigert Hall*,* 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/.

Student Complaints Campus*:* https://care.dso.ufl.edu.

On-Line Students Complaints*:* http://www.distance.ufl.edu/student-complaint-process.