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**ECE 4270: Communication Systems**  
**Section 001/843/400**

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<b>Class Location/Time</b>	111, Rhodes Hall Annex, Mon., Wed., and Fri., 8:00 – 8:50 a.m.. Zoom link will be posted on Canvas.
<b>Instructor</b>	Lu Yu ( <a href="mailto:luy@g.clemson.edu">luy@g.clemson.edu</a> ), 300b Riggs Hall
<b>Office Hours</b>	<ul style="list-style-type: none"><li>• Online-only. Zoom link will be posted on Canvas.</li><li>• 2:30—4:30 p.m.@Mon.</li><li>• Other times <b>by appointment</b>. Email me directly and <b>Never</b> message me on Canvas.</li></ul>
<b>Grader</b>	Chunpeng Shao < <a href="mailto:chunpes@g.clemson.edu">chunpes@g.clemson.edu</a> >
<b>Course Modality</b>	Hybrid
<b>Prerequisites</b>	ECE 3170 and ECE 3300, each with a C or better.
<b>Important Dates</b>	<ul style="list-style-type: none"><li>• Sep. 3, Tue. – Last day to drop a class or withdraw from the University without a W grade.</li><li>• Oct. 23, Fri. – Last day to drop a class or withdraw from the University without final grades.</li></ul>
	is subject to change

## Welcome to ECE 4270!

My desire is that everyone succeed in this course to as great an extent as possible; furthermore, my desire is that you succeed not only in this course but in applying what you learn throughout your careers. For this reason, we will cover a lot of material, but many of the procedures of the course have been designed to help you master the material. If you come to all the classes, do all the homework, take all the tests, learn how to do everything correctly after getting anything wrong, and ask questions when needed, you should be able to do well in this course. I commit to treating you fairly and with respect and doing all that I can to help you succeed.

For questions about administrative procedures or other questions not related to course content, the best way to contact me is by email.

## Course Description

Study of communication systems design and analysis. Topics include signals and spectra, baseband signaling and detection in noise, digital and analog modulation and demodulation techniques, communications link budget analysis.

## Student Learning Outcomes

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Upon completion of this course, you should have an understanding of principles of digital and analog communication including the following: signals and spectra, baseband signaling and detection in noise, digital and analog modulation and demodulation techniques, and communications link budget analysis\*.

## Required Materials

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Course notes, homework assignments and other materials are available for download on Canvas via <http://www.clemson.edu/canvas>.

Optional textbook: *Introduction to Analog and Digital Communications 2e* by Haykin and Moher, Wiley Publishers, ISBN 0-471-43222-9. This course does not require or even directly refer to this textbook, but it does cover the majority of the material. The following textbooks are additional sources: *Communication Systems 3ed* by Haykin, Wiley Publishers, ISBN 0-471-57176-8, *Modern Digital and Analog Communication Systems 4e* by Lathi and Ding, Oxford University Press, ISBN 978-0-19-533145-5, and *Digital Communications Fundamentals and Applications 2e*, Sklar, Prentice Hall Publishers, ISBN 0-13-084788-7.

## Topical Outline

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1. Introduction
2. The Fourier transform applied to communications: signal concepts, Fourier transforms, energy, power, periodic signals, linear time-invariant systems, correlation, spectral densities.
3. Amplitude, angle, and pulse modulation: amplitude modulation with and without carriers, quadrature multiplexing, frequency and phase modulation, pulse amplitude and position modulation.
4. Baseband data and digital bandpass modulation: sampling and quantization, pulse code modulation, delta modulation, differential PCM, line codes, inter-symbol interference, Nyquist channel, raised cosine signaling, eye patterns, equalization, partial response signaling, signal space concepts, amplitude shift keying, phase shift keying, QPSK, OQPSK, MSK, signal design for non-coherent reception, Mary signaling.
5. Random signals and noise: probability and random variables, random processes, correlation and spectral densities, effects of filtering, detection theory.
6. \*Noise analysis of communication systems: noise in AM and FM, FM pre-emphasis, coherent baseband detection, coherent bandpass detection, detection and performance with block and convolutional coding, noise figure and temperature, link calculations, terrestrial radio models.

## Grading

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Final grades will be based on the following weights: **20%** homework, **50%** for three in-class tests (20% for the first two tests and 10% for the 3<sup>rd</sup> test), and **30%** comprehensive final.

**A – 90% - 100%; B – 80 to < 90%; C – 70 to < 80%; D – 60 to < 70 & F – < 60%**

## Attendance Policy

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1. As a hybrid class, the university will assign each student a day of the week they are to come this class; on other days, they must attend online.
2. Attendance is optional on days students are to come physically.
3. Online attendance is optional. (Three cases here: hybrid students on their online days, hybrid students on their physical attendance days – meaning a hybrid student who chooses on their physical attendance day to attend online that day, and students who have chosen to be fully online.)
4. In the event of a class cancellation on a test day, the test is automatically postponed to the immediately following class unless otherwise noted.
5. Students are encouraged to use the Notification of Absence module in Canvas or email to inform the instructor of student absences.
6. Classroom entry and dismissal: To maintain physical distancing, individuals arriving first to the classroom should sit farthest from the door. Similarly, at the conclusion of class, students closest to the door should leave first.
7. Face masks is *strongly* recommended: While on campus, face coverings are required in all buildings and classrooms. Face coverings are also required in outdoor spaces where physical distance cannot be guaranteed. If a student does not have a face covering or refuses to wear an approved face covering without valid documented accommodation, the instructor will ask the student to leave the academic space and may report the student's actions to the Office of Community & Ethical Standards as a violation of the Student Code of Conduct. If the student's actions disrupt the class to the extent that an immediate response is needed, the instructor may call the Clemson University Police Department at 656-2222.
8. Please note that the University may convert to a purely online mode at any time. University classes are initially in a purely online mode and will remain so until Sept. 21.

## Additional Policies

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**Homework:** All problem sets are due at the time and date specified on the assignment. **No** late assignments will be accepted, and they are due at the time class begins. Because you have access

to the solutions. The purpose of the HW is to prepare you for the tests and final exam. I STRONGLY recommend you accomplish all the problems on your own first before looking at the solutions.

**Examinations:** No make-up exams will be given unless an acceptable reason is presented to the instructor **at least** one week before the examination date. We shall have **three** in-class tests, and a comprehensive final exam. Paper materials and references are allowed.

**Disputing Grades:** A student wishing to dispute a grade on a test must do so by emailing the grader within 24 hours after the instructor hands out the test in class. Appeals made after this deadline will **NOT** be considered. If the dispute cannot be resolved between the student and the grader, the student may bring the dispute to the instructor.

**Class Cancellation Policy:** Class is cancelled if the instructor is more than **15** minutes late to class.

## Academic Integrity

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As members of the Clemson University community, we have inherited Thomas Green Clemson's vision of this institution as a 'high seminary of learning.' Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form. In instances where academic standards may have been compromised, Clemson University has a responsibility to respond appropriately to charges of violations of academic integrity. Further information on Academic Integrity can be found in the [Undergraduate Announcements](#) and in the [Graduate School Policy Handbook](#).

## Access Accommodations

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Clemson University values the diversity of our student body as a strength and a critical component of our dynamic community. Students with disabilities or temporary injuries/conditions may require accommodations due to barriers in the structure of facilities, course design, technology used for curricular purposes, or other campus resources. Students who experience a barrier to full access to a class should let the instructor know and make an appointment to meet with a staff member in Student Accessibility Services as soon as possible. You can make an appointment by calling 864-656-6848 or by emailing [studentaccess@lists.clemson.edu](mailto:studentaccess@lists.clemson.edu). Students who receive Academic Access Letters are strongly encouraged to request, obtain, and present these to their instructors as early in the semester as possible so that accommodations can be made in a timely manner. It is the student's responsibility to follow this process each semester. You can access further information here: <http://www.clemson.edu/campus-life/campus-services/sds/>.

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## Anti-Harassment and Non-Discrimination

Clemson University is committed to a policy of equal opportunity for all persons and does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender, pregnancy, national origin, age, disability, veteran's status, genetic information or protected activity in employment, educational programs and activities, admissions and financial aid. This includes a prohibition against sexual harassment and sexual violence as mandated by Title IX of the Education Amendments of 1972. This policy is located at <http://www.clemson.edu/campus-life/campus-services/access/title-ix/>. Ms. Alesia Smith is the Clemson University Title IX Coordinator, and the Executive Director of Equity Compliance. Her office is located at 110 Holtzendorff Hall, 864.656.3181 (voice) or 864.656.0899 (TDD).

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## Emergency Procedures

Emergency procedures have been posted in all buildings and on all elevators. Students should review these procedures for their own safety. Students are required to monitor their university email (see <https://www.clemson.edu/studentaffairs/student-handbook/universypolicies/email-communications.html>) thus establishing this as a convenient method for official communication to students. Students are also encouraged to enroll in CU-Safe alerts. See <https://www.clemson.edu/cusafety> for more information.

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## Copyright Statement

Materials in this course are copyrighted. They are intended for use only by students registered and enrolled in this course and only for instructional activities associated with and for the duration of the course. They may not be retained in another medium or disseminated further. They are provided in compliance with the provisions of the Teach Act. Students should be reminded to refer to the Use of Copyrighted Materials and "Fair Use Guidelines" policy in on the Clemson University website for additional information: <https://clemson.libguides.com/copyright>.