

---

**ECE 4270**  
**Communication Systems**

---

<b>Class Location/Time</b>	111, Rhodes Hall, Mon., Wed., and Fri., 8:00 – 8:50 a.m.
<b>Instructor</b>	Fatemeh Afghah ( <a href="mailto:fafghah@clermson.edu">fafghah@clermson.edu</a> ), 334 Fluor Daniel Engineering Innovation Building
<b>Office Hours</b>	10:30—12:30 <a href="#">p.m.@Wed</a> (online) Other times <b>by appointment</b> . You can call me on Skype (ID:Fatemeh.afghah1)
<b>Grader</b>	Wang, Antian (tentative)
<b>Prerequisites</b>	ECE 3300: Signals, Systems, and Transforms
<b>Important Dates</b>	<ul style="list-style-type: none"><li>• Aug. 31 – Last day to drop a class or withdraw from the University without a W grade.</li><li>• Oct. 26 – Last day to drop a class or withdraw from the University without final grades.</li></ul>

[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.

[Course Objectives](#)

---

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

[Required Materials](#)

---

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

Optional textbooks:

- A First Course in Digital Communications, Ha Nguyen, Ed Shwedyk, Cambridge University Press.
- Digital Communications: Fundamentals and Applications, Bernard Sklar, 2th Edition, Prentice Hall.
- *Introduction to Analog and Digital Communications 2e* by Haykin and Moher, Wiley Publishers, ISBN 0-471-43222-9.

This course does not require or directly refer to these textbooks, but they do cover the majority of the material.

### Topical Outline

---

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. Random signals and noise: probability and random variables, random processes, correlation and spectral densities, AWGN noise.
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. Amplitude, angle, and pulse modulation: amplitude modulation with and without carriers, quadrature multiplexing, frequency and phase modulation, pulse amplitude and position modulation.
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

---

Final grades will be based on the following weights:

Homework:	20%
Quizzes and In-Class Activities:	10%
Two Highest In-Class Exams:	20% each
Lowest In-Class Exam:	10%

Comprehensive Final Exam: 20%

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

**Exams Schedule (*tentative*):**

Test 1: Friday, 09/17/21, 8-8:50 am.

Test 2: Friday, 10/15/21, 8-8:50 am.

Test 3: Friday 11/19/21, 8-8:50 am.

[Additional Policies](#)

---

**Course Structure and Evaluation Mechanisms:**

This course offering will consist of a number of elements: Lectures that meet three hours per week to present and discuss topics relating to digital communications, wireless networks, readings from the textbooks, papers and other closely related material that support and expand on lecture themes, homework assignments that will sharpen students' understanding of the material, and research projects that provide a chance to gain more in-depth understanding of a topic of interest. We will not only focus on theoretical aspects, but also explore the actual implementations and current technologies.

**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.

**The lowest homework grade will be dropped and one quiz with lowest grade will be dropped.**

**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.

**Cellphones** are not allowed in class.

At the professors' discretion, grading thresholds may be changed slightly. Each student's grade is based on their own outcomes assessments and not affected by the grades of other students.

Extra credit opportunities may present themselves throughout the semester and will be announced during class meetings.

**Evaluation Mechanisms:**

Assessments will be based on the following measures:

- **Homework** will be used to assess students' knowledge about course material and also to extend their knowledge and familiarize them with extensions, and applications of the learned topics. Homework will be provided almost weekly and the deadlines will be in about a week. The problems will be posted online and the students have the option of submitting their homework into Canvas or turning in the class. Homework will include conceptual questions, problem solving and MATLAB programming. Homework solutions will be posted after the due dates and we will go over more involving questions in the class if needed.
- **Quizzes** will be taken at least once a week with or without prior notice. Each quiz may take between 10 to 15 minutes. Quiz may include material from the same session. Quizzes will be designed to gage student's learning pace and also to identify their week points. Quiz solutions will be posted online.
- **Class attendance** will be evaluated either by attendance quizzes, sign off sheets or attendance check. Absence up to 2 session with prior notice after instructor's approval will be acceptable. Your engagement in in-class discussion really matter. The quiz grades and class attendance will contribute to 10% of your final grades.
- **In-class exams** include three midterm exams to assess students' pace of learning and mastery of student's knowledge in key course topics.
- **Projects** will be used to measure students' capability to do literature review, and explore the state of the art in related topics. Also student's ability in developing creative ideas and implementing algorithms will be assessed.

The final project is optional but highly encouraged. The project could be a research work related to a topic in digital communications and you are encouraged to use and apply the skills and knowledge you learned in other courses such as pattern recognition and cyber security. The project could have up to maximum 5% extra credits for research projects and up to maximum 10% extra credits for projects with simulations or hardware implementations. The outcomes of the project are a technical report and a presentation. The projects can be done by a team of two students. Depending on the selected topic, I can pair you with our graduate students to help you with the project. I will be happy to help you select a topic for your project. I also have multiple research positions available in my lab as a paid NSF undergraduate

research assistant, let me know if you are interested.

**Proposal:**

Proposal is a one-page write-up to explain the idea of your project, and the reason you have selected this topic. The proposal is due 09/24/21 at 8 pm. You are highly encouraged to discuss your ideas with the instructor before selecting a topic. You need to present your project for 5 minutes in the class to explain your topic and your plans.

**Final Paper:**

The four-page final report is a comprehensive study of the project topic, including literature review, possible methodologies and approaches, and analytical results. The final report is due on 12/03/21 at 8 pm.

**Presentation:**

Presentation days: 11/29/21 and 12/01/21 (10 minutes presentation and 5 minutes discussion).

## **STUDENT ACCESSIBILITY SERVICES**

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 this 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, by emailing [studentaccess@lists.clemson.edu](mailto:studentaccess@lists.clemson.edu), or by visiting Suite 239 in the Academic Success Center building. Appointments are strongly encouraged – drop-ins will be seen, if at all possible, but there could be a significant wait due to scheduled appointments. Students who have accommodations are strongly encouraged to [request, obtain, and send these \(Links to an external site.\)](#) to their instructors via SAS 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 at the [Student Accessibility website \(Links to an external site.\)](#). Other information is at the university's [Accessibility Portal \(Links to an external site.\)](#).

## **TITLE IX**

The Clemson University Title IX statement: 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 [Title IX policy \(Links to an external site.\)](#) is located on the Campus Life website. Ms. Alesia Smith is the Clemson University Title IX Coordinator, and the Executive Director of Equity Compliance. Her office is located at 223 Brackett Hall, 864.656.0620. Remember, email is not a fully secured method of communication and should not be used to discuss Title IX issues.

## **ACADEMIC INTEGRITY**

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.

All infractions of academic dishonesty by undergraduates must be reported to Undergraduate Studies for resolution through that office. In cases of plagiarism instructors may use the Plagiarism Resolution Form.

See the [Undergraduate Academic Integrity Policy \(Links to an external site.\)](#) website for additional information and [the current catalog \(Links to an external site.\)](#) for the policy. For graduate students, see the current [graduate student handbook \(Links to an external site.\)](#) for all policies.

## **EMERGENCY PREPAREDNESS STATEMENT**

Emergency procedures have been posted in all buildings and on all elevators. Students should be reminded to review these procedures for their own safety. All students and employees should be familiar with guidelines from the Clemson Police Department. [Visit here for information about safety. \(Links to an external site.\)](#)

## **ACADEMIC SUCCESS CENTER**

The [Academic Success Center \(Links to an external site.\)](#) (ASC) offers a variety of free learning and success services for all undergraduate students that include

Mastery of course content

- - - Tutoring – students can expect a 1:1 meeting with a trained undergraduate peer leader (who made an A or B in the course and was recommended by a faculty member) during which the student can share specific questions they have about course content with the tutor focused on helping the student, through questioning techniques and identification of helpful learning strategies, and master course concepts. Tutors do not help with homework or other class assignments.
    - Peer-Assisted Learning (PAL) – students can expect collaborative and active group learning and study sessions focused on mastery of course content and learning strategies that is facilitated by a trained undergraduate peer leader (who made an A or B in the course and was recommended by a faculty member). PAL leaders do not help with homework or other class assignments.

## **Learning and Success Strategies**

- - - Academic coaching - students can expect a 1:1 meeting with a trained professional academic coach during which the coach helps students see themselves, their skills, and their study habits from a fresh perspective through one-on-one sessions focused on learning and personal success strategies.

- Success strategy workshops – students can expect 30-45 minute workshops on college success skills, time management and organizational skills, test-taking strategies, study strategies, finals preparation, life skills, and academic resources.
- College success skills course (CU 1010) – students experiencing academic difficulty can expect a course focused on academic and personal skill building taught by instructors who wish to work with this student population

ASC services are designed to equip students with strategies and resources they can use to:

- - - Succeed in their courses
    - Become more confident, independent, and skillful learners
    - Engage in more productive and effective study and learning strategies
    - Manage their time more effectively

Location: The Class of 1956 Academic Success Center building is located in the center of campus adjacent to Cooper Library and the Watt Family Innovation Center.

## **TECH SUPPORT**

If you have trouble with Canvas or another university system, check here first: [Clemson System Status](#).

CCIT's IT Support Center offers a wide range of support options and hardware repair with several contact methods to help you answer your questions as quickly as possible:

- - - Phone: (864) 656-3494
    - Email: [ITHelp@clemson.edu](mailto:ITHelp@clemson.edu)
    - Chat: [Live Online Chat](#) (Links to an external site.)
    - Web Form: [Help Request Form](#) (Links to an external site.)
    - Troubleshoot: [Knowledge Base](#) (Links to an external site.)
    - Everything CCIT Does: [Browse Services](#)

## **Copyright Statement**

Materials in some of the courses are copyrighted. They are intended for use only by students registered and enrolled in a particular 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://www.clemson.edu/library/>.

**The instructor reserves the rights to make changes to the syllabus at any times.**