CLEMSON
ELECTRICAL AND COMPUTER ENGINEERING

ECE 4670/6670: INTRODUCTION TO DIGITAL SIGNAL PROCESSING
Section 001, 400, and 843
FALL 2020

MEETING TIME: Tuesdays and Thursdays, 12:30 -1:45 p.m.

MEETING LOCATION: (online course)

INSTRUCTOR: Dr. John N. Gowdy, 211 Riggs Hall, jgowdy@clemson.edu, 864 986 1273 (cell phone).

OFFICE HOURS AND PROCEDURES: Online office hours will be held from 3:30 – 4:30 p.m. on Tuesdays, Wednesday, and Thursdays. I will be available for phone calls, FaceTime calls, or Zoom meetings during those times. I will also check for email questions at least one a day, Monday through Friday.

COURSE MODALITY: Online Synchronous

COURSE DESCRIPTION: Introduction to characteristics, design, and applications of discrete time systems; design of digital filters; introduction to the Fast Fourier Transform (FFT); signal processing applications.

COURSE PREREQUISITE: ECE 3300 (or equivalent) with a C or better

STUDENT LEARNING OUTCOMES: At the completion of the course, students should be able to:

- demonstrate a thorough understanding of the fundamentals of digital signal processing
- design and realize different classes of digital filters using a variety of design techniques
- use MATLAB tools to design and analyze digital filters
- interpret and apply the outputs of the Discrete Fourier Transform (DFT)
- implement the DFT using the FFT algorithm.

REQUIRED MATERIALS: Textbook: *Fundamentals of Digital Signal Processing* by Lonnie C. Ludeman. Each student is required to have a laptop computer, printer, internet connectivity capable of transmitting and receiving video, a video camera, a microphone, and a cell phone. Note: Used copies of the textbook are usually available at very reasonable prices from abebooks.com, amazon.com, and thriftbooks.com.

TOPICAL OUTLINE: (with approximate number of weeks for each topic)

I. Introduction (.5)
II. Review of Discrete-Time Systems (2)
III. Application of Z-Transforms to Discrete-Time Signals and Systems (2)
IV. Analog Filter Design (1.5)
V. Digital Filter Design and Implementation (5.5)
VI. Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT) (3)
VII. Application Examples (.5)

CLASS CANCELLATION POLICY: This class, which will be presented this semester using the online synchronous mode, will typically begin which a short Zoom meeting at each scheduled meeting time (12:30 p.m. on Tuesdays and Thursday). Students are expected to wait at least 15 minutes if the Zoom

meeting doesn't start at the scheduled time. All these Zoom meetings will be recorded and posted on Canvas.

GRADING POLICY:

Grade Weighting for ECE 4670

QUIZ 1	20%
QUIZ 2	20%
QUIZ 3	20%
HOMEWORK	15%
FINAL EXAM	25%

• If the Final Exam grade is higher than at least one of the three Quiz grades, the lowest Quiz grade will be replaced by the Final Exam grade.)

Grade Weighting for ECE 6670

QUIZ 1	20%
QUIZ 2	20%
QUIZ 3	20%
HOMEWORK	5%
PROJECT	10%
FINAL EXAM	25%

* If the Final Exam grade is higher than at least one of the three Quiz grades, the lowest Quiz grade will be replaced by the Final Exam grade.)

• The project for ECE 6670 can involve MATLAB analysis or design of digital filters; a written review of an approved paper involving digital signal processing; or application of digital signal processing to a research project.

Grading Scale: for ECE 4670: A: 85 – 100 B: 75 - 84 C: 60 - 74 D: 50 – 59 F: 0 - 49

for ECE 6670: A: 85 – 100 B: 75 - 84 C: 60 - 74 F: 0 - 59

ATTENDANCE POLICY:

This class will be presented this semester using the online synchronous mode. Each class period will typically begin with a short Zoom meeting at 12:30 p.m. on the scheduled meeting days. These Zoom meetings will include topics such as course announcements, homework, quiz reviews, quiz solutions and an introduction to the current lecture. Students will also have an opportunity to ask questions. After each Zoom meeting, students will view a lecture video, which can be accessed via Canvas. Students are encouraged to view these videos immediately after the Zoom meetings. However, all lectures will continue to be available on Canvas, in case a student prefers to view them another time.

In the event of a class cancellation on a quiz day, the quiz will be given at a later date at one of the regularly scheduled class times. Students do not need to inform the instructor about absences, except for quiz days. There will be no make-up quizzes, except when a doctor's note confirms an illness.

HOMEWORK:

Homework will be assigned each week and will typically be due one week after it is assigned. Homework assignments will be provided via Canvas. To submit your homework, you will need to scan it

or take a picture of each page and send it by email to the course grader. Graded homework will be scanned and sent to you by email. Homework solutions will be posted on Canvas.

QUIZZES:

I will send each quiz to you by email just before the quiz time. You will need to have a printer available so you can print out a copy to work on. At the end of the allowed time, you will need to immediately scan your solutions, or take pictures of them, and email them directly to me. I will set up a Zoom session for the entire class while everyone is taking the quiz, so the grader and I can monitor everyone's activity, to ensure academic integrity. You will need to make arrangements to have a quiet place where you will not be disturbed while taking each quiz.

ACCESSIBILITY STATEMENT: 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. 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/.

TITLE IX STATEMENT: Clem[son 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.

SAFE CAMPUS: Clemson University is committed to providing a safe campus environment for students, faculty, staff, and visitors. As members of the community, we encourage you to take the following actions to be better prepared in case of an emergency:

a. Ensure you are signed up for emergency alerts (https://www.getrave.com/login/clemson)
b. Download the Rave Guardian app to your phone (https://www.clemson.edu/cusafety/cupd/rave-guardian/)
c. Learn what you can do to prepare yourself in the event of an active threat (http://www.clemson.edu/cusafety/EmergencyManagement/)

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. 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*.

MODIFICATION STATEMENT: The instructor reserves the right to modify any aspect of the syllabus at any time during the Fall 2020 semester for reasons including but not limited to COVID-related situations.