CLEMSON UNIVERSITY

# ECE 3300: Signals, Systems, and Transforms
# Fall 2017

**Prof. Carl Baum, Clemson University**
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**Course Meeting Time and Place: MWF 8:00–8:50 a.m., Kinard 301**
**Office Hours: MWF 10:10-11:00 a.m.**

## Welcome to ECE 3300!

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 class, really do the homeworks, and study effectively for tests, 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.

## Contacting Me:

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

For technical questions (help with homework problems, understanding lectures, going over old tests, etc.), see me during office hours, immediately after class in the classroom, or by appointment (if necessary). Because communicating mathematics by email is difficult, sending technical questions by email should only be used as a "last resort."

## Contacting You:

Important messages for the class will be communicated via Canvas announcements. You are responsible for the content of these messages. Canvas should be checked frequently so as to have the most recent information.

You may also be contacted individually via email, either via your university email ID or as a reply to an email initiated by you. It is your responsibility to check your email frequently or have it forwarded to an account that you check frequently. It is also your responsibility to make sure your email account stays below quota. Note that there are two email systems and corresponding addresses: username@clemson.edu and username@g.clemson.edu. You can set one to forward to the other or both to forward to another address. Make sure you can receive email from both addresses!

## Course Objectives:

Upon completion of this course, you should have an understanding of signal and system models and be able to use time-domain and transform techniques to facilitate the analysis of continuous-time and discrete-time signals and systems.

## Course Prerequisites:

The prerequistes for this course are ECE 2620 and MTHSC 2080.

## Course Materials:

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

Be aware that materials made available to the class including notes contain my intellectual property (the instructor). The redistribution of course materials by students in this course is strictly prohibited, particularly through formats that place this material for sale. Adding your own notes to course material does not change these conditions and does not mean that you own the material.

Optional textbook: *Signals and Systems 2e* by Oppenheim and Willsky, Prentice Hall publishers, ISBN 0-138-14757-4. This course does not require or even directly refer to this textbook, but it does cover most of the material.

## Software:

The use of MATLAB software is required in this course. See http://www.clemson.edu/ccit/software_applications/software/web_downloads.html for information about downloading this software. To use this software at Clemson via wi-fi you will also need eduroam, and to use it off campus you will need vpn. These are also available at the same link. If you have any issues with installing software and getting it to run properly, you should contact CCIT. Support information (phone, email, and chat) is also available at this link. MATLAB is free to Clemson students. The use of Gnu Octave, a free "emulator" of MATLAB, is not permitted, because there are critical differences between MATLAB and Octave.

## Grading:

Final grades will be determined by averaging the homework, tests, and the final exam based on the following scale:*

| | | | |
|---|---|---|---|
| Homework Assignments | 7.5% | A | 90% – 100% |
| MATLAB Assignments | 7.5% | B | 80% – 89% |
| 6 Tests (5 best kept) | 45% | C | 70% – 79% |
| Final Exam | 40% | D | 60% – 69% |

The lowest score of the 6 tests is dropped.

*Escape-with-a-C rule:* If you (1) have three or fewer unexcused absences, (2) turn in every homework and MATLAB assignment on time, receiving at least 50% on each assignment, and (3) receive an average of at least 55 on the midterm tests (after dropping the lowest score), then if your score on the final is at least as high as the overall C cutoff for the course, you will receive at least a C.

*Syllabus Quiz:* There is a required online (very easy) syllabus quiz. All assignments will receive a (permanent) score of zero until the syllabus quiz is completed.

*Calculus Review and Quiz:* There is a very short calculus review on canvas as well, along with a short (and hopefully easy) calculus quiz. You must receive a perfect score on the quiz to complete it. If you take the quiz more than three times, each additional taking of the quiz will subtract 1% from your overall percentage in the course. Retaking the quiz will give you different problems. All assignments will receive a (permanent) score of zero until the syllabus quiz is completed.

*The 90/80/70/60 grade cutoffs may be modified lower at my discretion. Normally such modifications are by no more than a few points; for example, the A cutoff might change from 90% to 88%. I reserve the right to modify the overall weighting scheme; for example, the relative weight of the final exam might be increased or decreased. Reasons for such a modification include the situation that I deem that a particular exam did not accurately assess student ability.

## Homework:

There are 14 homework assignments and 13 MATLAB assignments. Assignments are posted on Canvas. Homework solutions for all but the first homework are also posted. To receive full credit on the homework questions, all needed work must be shown. Just copying final answers from the solutions will give you zero credit. Do not use "ragged edge" paper torn from spiral notebooks. Detailed requirements for the MATLAB assignments are included in the assignments.

Assignments are due in class at the *beginning* of class on the dates indicated in the course schedule (part of this document). Absolutely no late assignments are accepted. No assignments are accepted by alternate delivery techniques such as email or under my office door.

Homework solutions must be written in your own handwriting; a copy of homework is not accepted, even if the copy is in your own handwriting. If you are retaking the course, you must write the solutions freshly.

On all MATLAB assignments you must follow the rules included in the first several assignments. Failure to follow these rules will have a significant cost in points up to receiving zero credit.

## Tests and the Final Exam:

The tests and the final exam are multiple choice. Tests are 50 minutes long and contain 12 questions, and the final is 150 minutes long and contains 30 questions. The number of correct answers is divided by the number of questions to obtain a percentage score. You must show your work on every problem, showing all steps on your test. When correct answers are found without the corresponding work or with incorrect work, those answers will be disallowed. Multiple correct answers without proper work shown will result in a score of zero on the test.

You will be provided a scantron sheet for each test. During the test, fill in the sheet using a number 2 pencil. Do not fill in the field marked "course"; your test ID will go there. Bring your ID.

Each of the six tests correspond to one chapter of the course; the final is cumulative and covers the entire course. No equations are provided on any exam. For the first test you may bring one 8.5x11 page of notes written on both sides of the paper. For the second test you may bring the first sheet plus one more. For the third test you may bring the first two sheets plus one more, and so on, up to the sixth test and the final, in which you may bring 6 sheets, one corresponding to each chapter of the course. Your exam sheets may contain theory, examples from the notes, homework problems, etc., but must not contain problems or answers from past exams.

## Disputing Grades:

Mistakes sometimes happen. To dispute a grade on homework or a test, attach a front page to the homework or test in question, write down the nature of the dispute, and give it to me within one week from the date that the item is returned in class. Disputes made after this deadline will not be considered.

## Class Attendance:

Class attendance is **mandatory**. Roll is taken at every lecture. Arriving late, leaving early, or being disruptive in class can be counted as an unexcused absence. You are expected to behave in a manner befitting a university student in class. Any deviations that produce distractions for other students or the instructor may result in ejection from the class, attendance penalties, and/or being dropped from the course. This prohibition includes the use of computers and other electronic devices for activities involving social media, watching movies, playing video games, or any other recreational activity. It might be quiet, but the students behind you will watch what you are doing, and therefore, be distracted. So any use of laptops after class time begins for anything except taking class notes must be approved in advance by me. Cell phones must be turned off during class.

Class attendance affects your final grade by adding or subtracting a percentage to your total grade percentage according to the following table:

| Unexcused absences | Change to total grade percentage |
|---|---|
| 3 or less | +5% |
| 4 to 6 | No change |
| 7 to 9 | −10% |
| 10 to 12 | −20% |
| 13 to 15 | −30% |
| 16 or more | −40% |

Absences for illness can only be excused with a doctor's note; absences for minor illness are not excused (but that is why there is an allowance for some unexcused absences in the table above). Absences for university activities require documentation and are considered on a case by case basis. Documentation must be on paper; email is not accepted.

Attendance may be taken orally or with a signup sheet. If a signup sheet is used, do not let anyone sign your name for you. The punishment for doing so is a penalty per incident of 6 unexcused absences to all involved.

There are generally no makeups or alternate dates for tests or the final. Exceptions for medical situations, etc., are at my discretion.

If I must cancel a class in advance, information will be posted as an announcement in Canvas. Class is also cancelled if I am more than 15 minutes late. In the event of a class cancellation for any reason, you should watch the corresponding video on Canvas. If homework was due on the date of a cancellation, it will instead be due at the following class. If a cancellation occurs on a test date, the test will be given in the following class.

### Academic Integrity:

Anyone caught in an act of academic dishonesty (cheating) will be penalized in accordance with Clemson University Academic Regulations.

### Disability Access:

It is University policy to provide, on a flexible and individualized basis, reasonable accommodations to students who have disabilities. If you are such a student, you are encouraged to contact Student Disability Services to discuss your individual needs for accommodation, obtain a letter if appropriate, and then discuss these needs with me. In order to obtain accommodations, you must provide me with an official accommodations letter no later than the end of the second week of class.

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 (e.g., opposition to prohibited discrimination or participation in any complaint process, etc.) 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. See http://www.clemson.edu/campus-life/campus-services/access/title-ix/ for more information including contact information for Clemson's Title IX Coordinator.

### Supplementary Help:

Supplemental review sessions or office hours may be made available shortly before chapter tests. Details of the times and locations will be announced on Canvas.

The Academic Support Center may offer tutoring sessions for ECE 3300 if enough students request that these services be provided. Go directly to the Academic Support Center if their services are of interest to you.

## Summary Topical Outline:

1. Introduction
2. Signals in the Time Domain
   *Transformations and combinations, step and impulse, periodic signals, complex-valued signals, energy and related quantities.*
3. Systems in the Time Domain
   *Checking system properties, linear time-invariant systems and convolutions, periodic inputs, composite systems.*
4. Signals in the Frequency Domain
   *Fourier and inverse Fourier transform, interpretation of magnitude and phase, Fourier series, Fourier transform of periodic signals.*
5. Systems in the Frequency Domain
   *Fourier analysis of linear time-invariant systems, interpretation of magnitude and phase response, group delay, ideal and nonideal filtering, Bode approximations, periodic inputs.*
6. Signals in the Laplace and Z Domain
   *Laplace/Z and inverse Laplace/Z transform, partial-fraction expansions, complex poles and quadratic factors, relationship to the Fourier transform.*
7. Systems in the Laplace and Z Domain
   *Laplace/Z analysis of linear time-invariant systems, differential/difference representations, poles and zeroes, composite systems, sampling.*

## Fall 2017 Course Schedule:

| Week | Date | Assignments | Date | Assignments | Date | Assignments |
|---|---|---|---|---|---|---|
| 1 | | | 08/23 | 1.1-2.1 | 08/25 | 2.2 |
| 2 | 08/28 | 2.3-2.4 | 08/30 | 2.5; H1A due | 09/01 | 2.6 |
| 3 | 09/04 | 2.7 | 09/06 | 2.8; H1B due | 09/08 | 2.9 |
| 4 | 09/11 | 2.10 | 09/13 | 3.1-3.2; H1C due | 09/15 | Test 1 |
| 5 | 09/18 | 3.3-3.4 | 09/20 | 3.5; H2A due | 09/22 | 3.6 |
| 6 | 09/25 | 3.7-3.8 | 09/27 | 4.1-4.2; H2B due | 09/29 | Test 2 |
| 7 | 10/02 | 4.3 | 10/04 | 4.4 | 10/06 | 4.5; H3A due |
| 8 | 10/09 | 4.6 | 10/11 | 4.7 | 10/13 | 5.1; H3B due |
| 9 | 10/16 | Fall Break | 10/18 | 5.2 | 10/20 | Test 3 |
| 10 | 10/23 | 5.3 | 10/25 | 5.4; H4A due | 10/27 | 5.5 |
| 11 | 10/30 | 5.6 | 11/01 | 6.1; H4B due | 11/03 | Test 4 |
| 12 | 11/06 | 6.2 | 11/08 | 6.3; H5A due | 11/10 | 6.4 |
| 13 | 11/13 | 6.5 | 11/15 | 7.1; H5B due | 11/17 | Test 5 |
| 14 | 11/20 | 7.2 | 11/22 | Thanksgiving | 11/24 | Thanksgiving |
| 15 | 11/27 | 7.3 | 11/29 | 7.4; H6A due | 12/01 | 7.5-7.6 |
| 16 | 12/04 | No class; self-study | 12/06 | Test 6; H6B due | 12/08 | No class; self-study |
| | 12/14 | Final 11:30am | | | | |

More about me: http://meettheprof.com/prof/carl-baum/