University of Texas at El Paso

EE 2353 – Continuous Time Signals & Systems

Fall 2022

Course Information

Meeting day and time: TR, 3:00 pm – 4:20 pm
Room: Psychology Building 308
Final Exam: Thursday, December 8th, 4:00 pm – 6:45 pm
Course designation: EE 2353 - 002
CRN: 15133
Credit hours: 3
Lecture hours: 3

Course Description: Representation and analysis of continuous time signals. Time and frequency analysis of linear time-invariant systems. Convolution, differential equations, Laplace transform, Fourier series and transform, and filters.

Instructor Information

Jesus J. Gutierrez, Ph.D.
Assistant Professor of Instruction
Office: ENGR A-338
Office Hours: MW 6:00 pm – 7:30 pm
TR 4:30 pm – 6:00 pm
F 10:00 am – 1:00 pm
E-mail: jjgutierrez4@utep.edu

Course Materials

- **Textbook (Main):**
  Signals & Systems: Theory and Applications
  Fawwaz T. Ulaby and Andrew E. Yagle
  Michigan Publishing, 2018, 670 pages
  Free PDF & Companion Website: http://ss2.eecs.umich.edu/

- **Textbook (Optional):**
  Linear Systems and Signals, 3rd Edition
  B.P. Lathi and R.A. Green
  Oxford University Press, 2018

- Pen/pencil and paper/notebook for taking notes.
- TI-85 scientific calculator or equivalent (No TI-nspire or equivalent, at professor’s discretion).
- Laptop with access to the internet and MATLAB software.
Some course content will be delivered through Blackboard. Also, important class announcements will be delivered via Blackboard and/or e-mail. Please make sure your UTEP e-mail is working, and you have stable access to the internet.

You can install MATLAB on your laptop or computer following the UTEP link: https://www.utep.edu/technologysupport/ServiceCatalog/SOFTWARE_PAGES/soft_matlab.html. You will be required to create a Mathworks account to download both the software and the license using your UTEP username and password.

If a student has no computer with access to the internet, from UTEP’s Technology Support Center has borrowing services for laptops and tablets: https://www.utep.edu/technologysupport/TSCenter/TSC_EQ_LaptopsTablets.html

UTEP’s Technology Support center also helps for technological needs beyond your scope of troubleshooting, so make sure you contact them if you encounter technical difficulties.

Students should maintain a well-organized notebook that archives their syllabus, lecture notes, homework problems, and tests. Students are also encouraged to purchase a USB Drive or use a cloud service like Dropbox or OneDrive to save their digital work.

**Prerequisites**

By Course (with grade of “C” or better):

- EE 2351 – Circuits II
- MATH 1312 – Calculus II
- MATH 2326 – Differential Equations

By Topic:

- Knowledge of passive and active circuit components.
- Algebra and calculus (integrals, derivatives, summations).
- Complex numbers and phasors.
- Linear Ordinary Differential Equations.

**Course Outline**

Topics covered in this course include:

1. Classification of signals and systems, transformations for periodic signals in the time-domain.
2. Linear Time-Invariant systems, impulse and step response, memory and stability.
3. Applications of the Laplace transform, including s-domain circuit analysis, op-amp circuits, system synthesis, basic control theory.
5. Applications of the Fourier Transform, 2D image filtering, active filters, filter design, Butterworth filters, resonator filter, modulation.
Course Outcomes

By the end of the semester, the student will be able to:

1. **Identify** the different classifications of signals and systems present in electrical engineering and **represent** their relationship using signal transformations and simple input-output models.

2. Fully **characterize** the response of linear time-invariant systems given any input signal and **understand** the role of characteristic modes in the overall system’s behavior.

3. **Design** practical systems that conform to specified transfer functions using Laplace Transform techniques and basic control theory.

4. **Understand** and **represent** periodic signals in terms of their frequency and phase components through Fourier series and calculate noise and harmonic distortion through power spectra.

5. **Apply** the Fourier Transform to **design** and **characterize** different types of filters to understand the basic principles of signal processing, communication systems, and sampling.

Contribution to Professional Component

EE 2351 is a sophomore level core course that builds on topics covered primarily in freshman and sophomore lower division required courses.

Relationship to (ABET) Program Outcomes

- An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
  
  *Students use mathematical and engineering concepts in the analysis and design of systems.*

- An ability to apply engineering design to produce solutions that meet specified needs:
  
  *Students use their newly acquired skills to design systems that meet specified constraints.*

- Ability to communicate effectively with a range of audiences:
  
  *Students solve signals and systems problems in teams and discuss with their classmates.*

- An ability to acquire and apply new knowledge as needed, using appropriate learning strategies:
  
  *Students learn to use MATLAB to design and analyze signals and systems.*

Rules and Policies

Grading

Student achievement in the course objectives will be assessed using a combination of in-class work, homework, quizzes, and exams. All student grades are protected by the Privacy Act of 1974.

Your course grade will be determined by your weighted performance in the following categories:

1. Homework ....................... 20%  
   90% – 100% → A

2. Weekly Quizzes .................. 20%  
   80% – 89% → B
3. Midterm Exam ..................25%  70% – 79% → C
4. Final Exam ..................25%  60% – 69% → D
5. Class Participation ..................10%  0% – 59% → F

For some students, there may be a “gray area” between two-letter grades in the final distribution, so two people getting the same weighted average grade could get different letter grades. If you are in one of these gray areas, whether you get a higher or lower grade depends primarily on two factors: (a) class participation and (b) whether your performance has been improving or declining over time.

**Weekly Quizzes Policy**

At the beginning of each Thursday class, with some exceptions, there will be a small quiz covering the material from the previous reading assignment and exercises. The weekly quizzes will account for 20% of the final grade. The time allotted for the quiz will be no more than 10 minutes. Only your hand-written notes are allowed along with your calculator, pen/pencil, and eraser. The lowest 2 quiz grades will be dropped.

Your quiz should be your own work. Students suspected of cheating or copying quizzes will be submitted to the Office of Student Conduct and Conflict Resolution (OSCCR) and will be part of your permanent record at UTEP.

**Homework Policy**

Homework will be due on Thursday at the beginning of each class. Any submissions later than this time-frame window will be marked as late.

Homework is an integral part of the course. It is crucial that you promptly and effectively do all your homework, as it will be useful for your learning and preparing for the tests.

Your homework must be your own work. Students suspected of cheating or copying homework will be submitted to the Office of Student Conduct and Conflict Resolution (OSCCR) and will be part of your permanent record at UTEP.

~ Missed Homework ~

Homework will be due at the beginning of each class. If for some reason you cannot finish the homework on the due date and time, the grade will be reduced proportionately to the days passed after the due date (50% for each day passed).

**Exam Policy**

There will be one midterm and one final exam, each accounting for 25% of the grade.

You will only be allowed to have the materials that are required for the test (calculator, pen or pencil, eraser, one cheat sheet of your own handwriting with your name and UTEP ID on both sides of the paper).

Full work must be shown for full credit. Work must be neat and well organized.

The final answer must be boxed and given proper units.

Your exam should be your own work. Students suspected of cheating will be submitted to the Office of Student Conduct and Conflict Resolution and will remain part of your permanent record at UTEP.
~ Missed Exams ~

A missed exam can be made-up **IF AND ONLY IF**:

1. the reason for missing the exam is beyond the student’s control: medical excuse, jury duty, death in the family or automobile accident, and

2. **prior consent** is obtained from the professor for missing the exam based on a non-frivolous reason, e.g., such as a job interview, conference, or out-of-town job-related travel.

In either case, the student must submit a written and signed statement the day before the exam, describing the reasons for missing, appropriate documentation, and petition for a make-up exam. A **missed exam will carry zero grade if conditions are not met**.

**Class Participation Policy**

Students are required to attend class and to show up to lectures on time. The course instructor reserves the right to turn away late comers and to withdraw students from the course that are repeatedly absent. Students missing more than two lectures should seriously reflect on their commitment to this course, as missing classes is highly correlated with poor performance.

Students absent from lecture are still held responsible for all information discussed, homework assigned, and exams during that missed lecture.

Participation will be comprised mainly of questions asked by the professor, small group discussions and in-class assignments. Participating in class does not necessarily mean talking a lot or asking a lot of questions. Some of the most helpful things you can do to enrich participation is doing class work, helping fellow classmates by explaining during group exercises, answer questions asked by the professor in a thoughtful manner or make an insightful comment that shows interest in what another fellow classmate said, building on ideas or questions.

There are also multiple ways quieter learners can participate, like honest and serious participation through student response systems, participate in class work, and engage with the professor during office hours.

The grading rubric for class participation will be based on the frequency and quality of contributions to the class:

- (9-10%): Attends regularly, often contributes to participation in the ways described.
- (7-8%): Attends regularly, sometimes contributes to participation in the ways described
- (5-6%): Attends regularly, rarely contributes to participation in the ways described.
- (<5%): Attends regularly, never contributes to class participation in the ways described.

**Class Etiquette**

- Ask questions! Despite how “silly” or “dumb” you may think your question is, it is very likely that other students have the same question. Confusion on even small details in course material can cause bigger problems and hold you back. If you are
truly embarrassed by your question, send me an anonymous e-mail. I promise I will respond!

- Respond honestly to polls and provide real-time feedback to instructor about the course. This will contribute greatly to the quality of the course and your success in it.
- Visit the course instructor during office hours, or by appointment, if needed.
- Treat e-mail correspondence as a professional exchange of information.
- Turn off cell phones, pagers, or anything else that may distract the class.
- Take notes during class and read the assigned sections of the book.
- Bring all of your course materials (textbook, notebook, pens/pencils, paper, calculator) to every class.
- Show proper etiquette during class. Do not talk, make excessive noise, or otherwise distract the class. You will be asked to leave, and it will affect your grade.

Course Calendar

This is a tentative schedule of the course topics, and assignments, subject to change.

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<thead>
<tr>
<th>Week</th>
<th>Dates</th>
<th>Topic</th>
<th>Assignments</th>
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<td>1</td>
<td>Aug 23-25</td>
<td>1. Intro to Signals and Systems</td>
<td></td>
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<tr>
<td>2</td>
<td>Aug 30-Sept 1</td>
<td>1. Intro to Signals and Systems</td>
<td>HW 1, Quiz 1</td>
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<tr>
<td>3</td>
<td>Sept 6-8</td>
<td>2. LTI Systems</td>
<td>HW 2, Quiz 2</td>
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<td>4</td>
<td>Sept 13-15</td>
<td>2. LTI Systems</td>
<td>HW 3, Quiz 3</td>
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<td>5</td>
<td>Sept 20-22</td>
<td>2. LTI Systems</td>
<td>HW 4, Quiz 4</td>
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<td>6</td>
<td>Sept 27-29</td>
<td>3. Applications of Laplace</td>
<td>HW 5, Quiz 5</td>
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<td>7</td>
<td>Oct 4-6</td>
<td>3. Applications of Laplace</td>
<td>HW 6, Quiz 6</td>
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<td>8</td>
<td>Oct 11-13</td>
<td>3. Applications of Laplace</td>
<td>HW 7, Quiz 7</td>
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<td>9</td>
<td>Oct 18-20</td>
<td>4. Fourier Series</td>
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<td>11</td>
<td>Nov 1-3</td>
<td>4. Fourier Series</td>
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<tr>
<td>12</td>
<td>Nov 8-10</td>
<td>4. Fourier Series</td>
<td>HW 9, Quiz 9</td>
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<td>13</td>
<td>Nov 15-17</td>
<td>5. Fourier Transform</td>
<td>HW 10, Quiz 10</td>
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<td>14</td>
<td>Nov 22</td>
<td>5. Fourier Transform</td>
<td>HW 11, Quiz 11</td>
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<td>15</td>
<td>Nov 29-Dec 1</td>
<td>5. Fourier Transform</td>
<td>HW 12, Quiz 12</td>
</tr>
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Academic Dishonesty

As an entity of The University of Texas at El Paso, the Department of Electrical and Computer Engineering is committed to the development of its students and to the
promotion of personal integrity and self-responsibility. The assumption that a student’s work is a fair representation of the student’s ability to perform is the basis for departmental and institutional quality. All students within the Department are expected to observe appropriate standards of conduct.

Any student who commits an act of scholastic dishonesty is subject to discipline. Scholastic dishonesty includes but is not limited to cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts.

Any case involving academic dishonesty will be referred to the Office of the Dean of Students. The Dean will assign a Student Judicial Affairs Coordinator who will investigate the charge and alert the student as to its disposition. Consequences of academic dishonesty may be as severe as dismissal from the University. See the Office of the Dean of Students’ homepage (Office of Student Life) at http://studentaffairs.utep.edu/dos for more information.

You can also refer to the IEEE website for information on our code of ethics: http://www.ieee.org/about/corporate/governance/p7-8.html

**American Disabilities Act**

The University is committed to providing services, equipment, and accommodations to individuals with documented disabilities to provide them with equal opportunities to participate in programs, services, and activities in compliance with Sections 503 and 504 of the Rehabilitation Act of 1973, as amended, and the Americans with Disabilities Act (ADA) of 1990, and the Americans with Disabilities Act Amendments Act (ADAAAA) of 2008. If you have a disability and need classroom accommodations, please contact The Center for Accommodations and Support Services (CASS) at 747-5148, or by email to cass@utep.edu, or visit their office located in UTEP Union East, Room 106. For additional information, please visit the CASS website at www.sa.utep.edu/cass.

**Discrimination Statement**

I do not discriminate, nor will I allow discrimination, on the basis of race, color, national origin, sex, religion, age, disability, genetic information, veteran’s status, sexual orientation, or gender identity. Members of the UTEP community are protected from discrimination and harassment by the State and Federal Laws.

**University Resources**

**Technology Resources**

- UTEP Technology Support: Students experiencing technological issues or challenges (e-mail, Blackboard, software, etc.) can submit a ticket to the UTEP Helpdesk for assistance. www.utep.edu/technologysupport
• **UTEP Engineering Technology Center (ETC):** Provides laptop and computer repair services for engineering students, as well as service requests for software. [www.utep.edu/engineering/etc/](http://www.utep.edu/engineering/etc/)

### Academic Resources

• **UTEP Library:** Access to a wide range of resources including online, full-text access to thousands of journals and e-Books, plus reference services and librarian assistance for enrolled students. [www.utep.edu/library/](http://www.utep.edu/library/)

• **Math Resource Center for Students (MaRCS):** Ask a tutor for help (including remotely) and explore available math resources like formula sheets, tables, and videos. [www.utep.edu/science/math/marcs](http://www.utep.edu/science/math/marcs)

• **Advancement Center for Engineering Students (ACES):** Students serving other students. Hybrid tutors provide tutoring for a wide range of topics including engineering, math and science, and also manages room reservations. [www.utep.edu/engineering/student-resources/student-resources-aces.html](http://www.utep.edu/engineering/student-resources/student-resources-aces.html)

### Individual/Well-Being Services

• **YWCA Early Learning Academy:** Conveniently located on campus to serve the UTEP community, YWCA’s Early Learning Academy is the best childcare solution for UTEP students, faculty, and staff. [https://www.utep.edu/student-affairs/early-learning-academy/](https://www.utep.edu/student-affairs/early-learning-academy/)

• **Military Student Success Center:** Assists personnel in any branch of service to reach their educational goals. [www.utep.edu/student-affairs/mssc/](http://www.utep.edu/student-affairs/mssc/)

• **Center for Accommodations and Support Services (CASS):** Assists students with ADA-related accommodations, for coursework, housing, and internships. [www.utep.edu/student-affairs/cass](http://www.utep.edu/student-affairs/cass)

• **Counseling and Psychological Services:** Provides a variety of counseling services including individual, couples, and group sessions, as well as career and disability assessments. [www.utep.edu/student-affairs/counsel](http://www.utep.edu/student-affairs/counsel)