EE3353: DISCRETE-TIME SIGNALS AND SYSTEMS
SYLLABUS FOR SUMMER 2022 (CRN: 31676)

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OFFICE HRS.:   Tuesday, Thursday (4:30PM – 5:30PM)
(At other times by appointment. Please email to confirm availability.)

CLASS TIME/PLACE: **Monday, Tuesday, Wednesday, Thursday, and Friday**
2:00 PM – 4:10 PM (CRN: 31676)
Location: EDCU 318

TEXTBOOK: *DSP First, Second Edition* by James H. McClellan, Ronald Schafer, and Mark Yoder, Pearson, 2016 (use of earlier editions is NOT recommended, there are too many differences).
This is the companion Web site: **https://dspfirst.gatech.edu/**
The textbook is available through the UTEP Bookstore. To buy the e-book directly from the publisher visit:
https://www.pearson.com/us/higher-education/program/Mc-Clellan-DSP-First-2nd-Edition/PGM86857.html

PREREQUISITE: EE2350 Electric Circuits 1 and CS1320 both with a minimum grade of "C".

CATALOG DESCRIPTION: Representation and analysis of discrete time signals and systems, digital filtering, sampling, spectrum analysis, Z-transform, DT Fourier transform, and the DFT. Emphasizes computer simulations and some basic applications to communications, control and signal processing.

PREREQUISITE BY TOPIC: Calculus and differential equations; complex numbers and functions; basic time-domain and steady-state circuit analysis; basic familiarity with MATLAB software tools.

COURSE DELIVERY AND MODIFICATIONS OVERVIEW:
 The class is starting 100% in-person with support and enhancements using Blackboard (BB) (recorded videos, document handouts, turning in take-home assignment, if any, etc.). Quizzes and exams will begin as in-person, face-to-face or take home assignments. The companion Web site of the textbook is very extensive, make sure to access it as soon as possible. We will be continuing with the new scheme where EE2353 is NOT a pre-requisite for this course. Thus, it covers the material at a lower level than past EE3353 courses.

 The modified approach will follow the new textbook with an accelerated pace on the first few chapters covering sinusoids and spectra of signals. First there is review of basic topics related to real and complex exponentials (AKA complex sinusoids) and sums and other basic combinations of sinusoids. The phasor concept is re-visited from Circuits to relate real and complex sinusoids. For sums of sinusoids, a graphical complex spectrum representation is presented and illustrated. Basic time-domain signal transformations and their effect on the spectrum are discussed. A brief introduction to Fourier Series is presented as a special case of sums of sinusoids. Next we make the transition to discrete-time signals by considering sampled sinusoidal signals.   The basic linear system concepts are then introduced with running average systems and other simple finite-impulse-response (FIR) digital filters. Impulse sequences are presented leading also to the impulse response characterization of a filter. Convolution is treated as a numerical operation using discrete-time signals and systems. The key concept of frequency response is derived and interpreted for FIR filters emphasizing the magnitude and phase changes experienced by sums of sinusoid when filtered by a linear time-invariant system. Next, the concept of discrete-time Fourier transform (DTFT) arises naturally including the inverse DTFT allowing us to define ideal filters. We then move to the discrete Fourier transform (DFT) deriving it as a sampled version of the DTFT and computable through popular fast algorithms that are not discussed in detail. The ideas of DTFT and DFT allows for an understanding of practical

spectrum analysis to successfully employ the powerful spectrum analysis tools readily available in software environments such as MATLAB. Finally, the z-transform is introduced in Chapter 9 and (Infinite Impulse Response) IIR systems in Chapter 10. At this stage, a student will be rewarded with the ability to understand applications involving the sampling theorem, discrete-time filtering, and spectrum analysis. Furthermore, they will be prepared to move on to courses in linear analog circuits, continuous-time signals and systems. In general, this course will also help prepare students for Senior (and graduate) level courses in Controls, Communications and Signal and Image Processing.

COURSE GRADING

- One Midterm and One Final Exams (face-to-face)   **50% (TENTATIVE)**
    (for face-to-face exams, self-prepared Notes and Tables would be allowed)
- HomeWorks, MATLAB Projects   **20% (TENTATIVE)**
- Quizzes   **30% (TENTATIVE)**
    Total   **100%**

KEY DATES: Dates for Quizzes, Homework Assignments, Midterm Exams, and Final Exams are listed in the schedule of classroom lectures. It will be distributed in the classroom.

USE OF E-MAIL: Each student is required to read their officially registered UTEP e-mail account often enough to monitor ongoing information related to this course including Blackboard announcements. For the most part, blackboard uploading of instructor produced documents replaces the use of direct e-mail delivery.

USE OF BLACKBOARD: UTEP rules and guidelines will be used if it is necessary to switch to online or Hybrid delivery. Every effort will be made to keep the face-to-face, in person exams, whenever possible.

COMPUTER USAGE: The MATLAB software package (with many Toolkits and Toolboxes) is made available via download or a DVD or direct install on your laptop to all Engineering Students from the Engineering Technology Center (ETC). **http://etc.utep.edu/** Tel. (915)747-5223, E-mail: **etchelpdesk@utep.edu.** Most likely, you simply download Matlab that does not need the VPN from **www.utep.edu/matlab**

IMPORTANT POLICY:
- HomeWorks will be graded pass-fail to emphasize attempting the problems and using the solutions later to check your work. Some problems will be solved in class, solutions or brief answers will be provided well before quizzes are given.
- Quizzes will be based on the last two class lectures. The approach will be closed book (tentative), solve by hand, with limited time allowed during the class time period.
- Exams rules will be determined for each exam the week prior to its offering. These exams are to be solved by hand with self-prepared, handwritten notes and paper copies of key textbook Tables allowed.
- If there is any suspected copying on quizzes and exams, seating arrangements will be used. In all cases, the uniqueness of the solution process will be evaluated, and suspected incidents will be documented for eventual reporting to the University academic dishonesty authorities.

TOPICS TO BE COVERED (the exact order, pages and/or sections and subsections will be listed in homework handouts and/or will be sent via e-mail).

I- Sinusoids, Spectrum Representation, Sampling and Aliasing (focus on sums of sinusoids, Chapters 2-4, Appendix C)

II- Finite Impulse Response (FIR) Filters and their Frequency Response (Chapter 5-6).

III- Discrete-Time Fourier Transform (DTFT) and Discrete Fourier Transform (DFT) (Chapters 7-8)

IV- Z-Transform (Chapter 9)

V- Infinite Impulse Response (IIR) Filters (Chapter 10)

EFFORT, PARTICIPATION and ETIQUETTE:
- Students (domestic or international, no exceptions) that are clearly not doing the homework's, are failing quizzes, and who fail Exam 1 will be dropped from the course unless there are extenuating circumstances or Visa complications (let's discuss it).
- Ask questions of broad interest, your fellow students will also benefit.
- Bring your book to class if possible.
- Turn down the sound on cell phones, beepers, i-pods, etc. during the class period.
- The use of cellular phones during exams and quizzes is strictly prohibited, put them away and out of reach.
- **Fairness statement**: the key fairness criterion for this course is equal opportunity for all students to receive feedback, help, information, scores, handouts, etc., individual requests cannot be accommodated. Variability in the difficulty of quizzes and exams is adjusted by curving the scores before entering into the final semester score formula. Typically, this means obtaining a score on a scale of 100% by dividing the raw score by a constant S=approximately the 3rd highest score in the class on that Exam or for the total score for all quizzes. Grades are not negotiable individually but fair adjustments can be made for the whole class.

ACADEMIC INTEGRITY: Please review the statements below and UTEP's Web page on Policy on Academic Integrity at: **https://www.utep.edu/student-affairs/osccr/student-conduct/academic-integrity.html**

Academic dishonesty is prohibited and is considered a violation of the UTEP Handbook of Operating Procedures. It includes, but is not limited to, cheating, plagiarism, and collusion. Cheating may involve copying from or providing information to another student, possessing unauthorized materials during a test, or falsifying research data on laboratory reports. Plagiarism occurs when someone intentionally or knowingly represents the words or ideas of another person's as ones' own. And, collusion involves collaborating with another person to commit any academically dishonest act. Any act of academic dishonesty attempted by a UTEP student is unacceptable and will not be tolerated. Violations will be taken seriously and will be referred to the Dean of Students Office for possible disciplinary action. Students may be suspended or expelled from UTEP for such actions.

Academic dishonesty is an assault upon the basic integrity and meaning of a University. Cheating, plagiarism, and collusion in dishonest activities are serious acts which erode the University's educational and research roles and cheapen the learning experience not only for the perpetrators, but also for the entire community. It is expected that UTEP students will understand and subscribe to the ideal of academic integrity and that they will be willing to bear individual responsibility for their work. Materials (written or otherwise) submitted to fulfill academic requirements must represent a student's own efforts. Any act of academic dishonesty attempted by a UTEP student is unacceptable and will not be tolerated. Violations will be referred to the Dean of Students Office for possible disciplinary action. Students may be suspended or expelled from UTEP for such actions.