

ECE 4213/5213

Digital Signal Processing

Fall 2023

TIME: MW 4:30 – 5:45 PM

PLACE: Physical Science Center PHSC 0108

INSTRUCTOR:

Dr. J.P. Havlicek

DEH 333

Tel: (405) 325-8131

Office Hours: MW 3:15 – 4:15 PM and by appointment

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ASSISTANT:

Elnaz Aghdaei

DEH 346

Office Hours: T 12:00 – 1:00 PM and by appointment

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TEXT & REFERENCES:

1. A.V. Oppenheim and R.W. Schaffer, *Discrete-Time Signal Processing*, 3rd ed., Prentice Hall/Pearson, Upper Saddle River, NJ, 2010.
2. S.K. Mitra, *Digital Signal Processing Laboratory Using Matlab*, McGraw-Hill, New York, 1999 (out of print but available on the course web site).
3. Matlab use is required for this course. The following toolboxes are also required: Symbolic Math, Signal Processing, DSP, Control Systems. OU has a campus-wide Matlab license – see handout on the course web site. Install from the Mathworks web site at <https://www.mathworks.com/academia/tah-portal/university-of-oklahoma-norman-557289.html>. Alternatively, you can purchase the Matlab and Simulink Student Suite for \$99: http://www.mathworks.com/academia/student_version/. Matlab is also available on the College of Engineering Virtual Lab (see handout on the course web site).

PREREQUISITES:

Graduate standing in ECE *or* ECE 3793, Signals and Systems

COURSE WEB SITE: <http://coecs.ou.edu/Joseph.P.Havlicek/ece5213/>

Lecture notes, handouts, homework assignments, homework solutions, test solutions, and certain other information will be posted to the course web site.

CANVAS: <http://canvas.ou.edu>

Canvas will be used primarily for submitting homework assignments. Canvas grading will **not** be used in this course. More information about grading is given later in this syllabus.

REASONABLE ACCOMMODATION POLICY:

The University of Oklahoma is committed to providing reasonable accommodation for all students with disabilities. Students with disabilities (including temporary medical conditions and pregnancy) may receive accommodations by contacting the Accessibility and Disability Resource Center at 730 College Avenue, (405) 325-3852 (Tel) or adrc@ou.edu. The Accessibility and Disability Resource Center web site is located at <https://www.ou.edu/adrc>.

RELIGIOUS HOLIDAYS:

It is the policy of the University to excuse absences of students that result from religious observances and to provide without penalty for the rescheduling of examinations and additional required classwork that may fall on religious holidays. It is the responsibility of the **student** to make alternate arrangements with the instructor *at least one week prior to the actual date of the religious holiday*.

UNIVERSITY POLICY ON ACADEMIC HONESTY:

<http://integrity.ou.edu>

This page outlines the University's expectations of academic honesty, defines misconduct, provides examples of prohibited conduct, and explains the sanctions available for those found guilty of misconduct. Additional information about the meaning of *academic misconduct* in this course is provided later in this syllabus.

The UOSA Statement of Academic Integrity will be used in this course.

COURSE DESCRIPTION:

This course will provide an introduction to the fundamental techniques of digital signal processing, including discrete-time linear systems, finite impulse response digital filters, infinite impulse response digital filters, fast Fourier transforms, response of LTI systems to statistical signals, digital filter design, and applications.

HOMEWORK:

Homework assignments and solutions will be posted to the course web site. Working the homework problems on time will help YOU to do well on the tests and exam.

Homework assignments will be submitted electronically on Canvas and will generally be due at midnight on the published due date.

For paper and pencil homework assignments, you will scan or photograph your paper and upload it to Canvas.

For Matlab homework assignments, you will be provided with an MS WORD shell file to use in developing your solution. Once you complete the assignment, you can print the file to PDF and upload the PDF version to Canvas (preferred). If you have difficulty printing to PDF, you can alternatively upload your completed WORD file to Canvas.

You are encouraged to work together on homework, but **DO NOT COPY!** Each problem solution that you turn in must be your own;

- **If** you copy another person's solution and turn it in as your own, **then** *you are guilty of academic misconduct.*
- **If** you copy an old homework solution without working the problem yourself and turn it in, **then** *you are guilty of academic misconduct.*

These standards of academic honesty apply to Matlab assignments as well. In addition:

- **If** you obtain code or results from another person in an electronic format and incorporate it into the solution that you turn in, **then** *you are guilty of academic misconduct.*
- **If** you obtain code or results from another person in electronic or hardcopy formats and then type it into the solution that you turn in, **then** *you are guilty of academic misconduct.*

LATE HOMEWORK POLICY:

Late homework will not be accepted. There are two reasons for this policy. First, accepting a late homework assignment from one person is unfair to others who may have stayed up all night to get the assignment done and may also have sacrificed grades in other classes to get it done. Second, it would be detrimental to the overall learning outcomes of the class to delay the posting of homework solutions in order to accommodate late assignments.

TESTS & EXAM:

There will be two tests and a cumulative final exam. Each test will be announced in class at least one week in advance.

The tests and exam are OPEN BOOK and OPEN NOTES. Calculators are allowed. You should also bring a clean copy of the formula sheet that is published on the course web site. Other materials are NOT ALLOWED. On each test and on the final exam, students enrolled for undergraduate credit (ECE 4213) will be permitted to omit one problem.

The tests and exam are *individual* exercises. **If** you collaborate with another person on a test or exam, **then** *you are guilty of academic misconduct.*

Makeup tests will not be given. If you miss a test and your absence is NOT officially excused, then you will receive a zero grade for that test. If you miss a test and your absence IS officially excused, then your final exam grade will be used in place of the missed test grade.

Please note that this course is *exempt* from the University Final Exam Preparation Period policies (i.e., "Dead Week" policies).

GRADING:

Your final average will be calculated as shown in the table below.

What	Value
Homework	20%
Test One	25%
Test Two	25%
Final Exam	30%

These numerical grades will be converted into letter grades using a curve determined by the instructor. For each section (ECE 4213 and ECE 5213), the same curve will be applied to everyone in the class. The curve will never hurt your grade relative to the standard ten-point grading scale.

TOPICS:

1. Introduction
2. Time domain representation and analysis
3. Fourier transform, distribution theory, distributional Fourier transforms
4. z -transform
5. Digital processing of analog signals
6. Discrete Fourier transform (DFT)
7. LTI systems in the frequency domain
8. Analog filter design
9. IIR digital filter design
10. FIR digital filter design
11. Digital filter structures
12. LTI filters with statistical inputs
13. Introduction to multirate signal processing
14. Finite wordlength effects

ADDITIONAL REQUIRED UNIVERSITY LEGAL & POLICY STATEMENTS

TITLE IX RESOURCES AND REPORTING REQUIREMENT:

Anyone who has been impacted by gender-based violence, including dating violence, domestic violence, stalking, harassment, and sexual assault deserves access to resources so that they are supported personally and academically. The University of Oklahoma is committed to offering resources to those impacted, including: speaking with someone confidentially about your options, medical attention, counseling, reporting, academic support, and safety plans. If you would like to speak with someone confidentially, please contact OU Advocates (available 24/7 at 405-615-0013) or another confidential resource (see “Can I make an anonymous report?”). You may also choose to report gender-based violence and discrimination through other means, including by contacting the Institutional Equity Office (ieo@ou.edu, 405-325-3546) or police (911). Because the University of Oklahoma is committed to the safety of you and other students, I, as well as other faculty, Graduate Assistants, and Teaching Assistants, are mandatory reporters. This means that we are obligated to report gender-based violence that has been disclosed to us to the Institutional Equity Office. This includes disclosures that occur in: class discussion, writing assignments, discussion boards, emails and during Student/Office Hours. For more information, please visit the Institutional Equity Office.

ADJUSTMENTS FOR PREGNANCY/CHILDBIRTH RELATED ISSUES:

Should you need modifications or adjustments to your course requirements because of documented pregnancy-related or childbirth-related issues, please contact your professor or the Accessibility and Disability Resource Center at 405/325-3852 as soon as possible. Also, see the Institutional Equity Office FAQ on Pregnant and Parenting Students’ Rights for answers to commonly asked questions.

EMERGENCY PROTOCOL:

During an emergency, there are official university procedures that will maximize your safety.

Severe Weather: If you receive an OU Alert to seek refuge or hear a tornado siren that signals severe weather.

1. Look for severe weather refuge location maps located inside most OU buildings near the entrances
2. Seek refuge inside a building. Do not leave one building to seek shelter in another building that you deem safer. If outside, get into the nearest building.
3. Go to the building’s severe weather refuge location. If you do not know where that is, go to the lowest level possible and seek refuge in an innermost room. Avoid outside doors and windows.
4. Get in, Get Down, Cover Up
5. Wait for official notice to resume normal activities.

Additional Weather Safety Information is available through the Department of Campus Safety.

ADDITIONAL REQUIRED UNIVERSITY LEGAL & POLICY STATEMENTS...

ARMED SUBJECT/CAMPUS INTRUDER:

If you receive an OU Alert to shelter-in-place due to an active shooter or armed intruder situation or you hear what you perceive to be gunshots:

1. *Avoid*: if you believe you can get out of the area WITHOUT encountering the armed individual, move quickly towards the nearest building exit, move away from the building, and call 911. 2. *Deny*: if you cannot flee, move to an area that can be locked or barricaded, turn off lights, silence devices, spread out, and formulate a plan of attack if the shooter enters the room. 3. *Defend*: as a last resort fight to defend yourself.

For more information, visit OU's Emergency Preparedness site.

FIRE ALARM/GENERAL EMERGENCY:

If you receive an OU Alert that there is danger inside or near the building, or the fire alarm inside the building activates: 1. *LEAVE* the building. Do not use the elevators. 2. *KNOW* at least two building exits 3. *ASSIST* those that may need help 4. *PROCEED* to the emergency assembly area 5. *ONCE* safely outside, *NOTIFY* first responders of anyone that may still be inside building due to mobility issues. 6. *WAIT* for official notice before attempting to re-enter the building.

MENTAL HEALTH SUPPORT SERVICES:

If you are experiencing any mental health issues that are impacting your academic performance, counseling is available at the University Counseling Center (UCC). The Center is located on the second floor of the Goddard Health Center, at 620 Elm Rm. 201, Norman, OK 73019. To schedule an appointment call (405) 325-2911. For more information, please visit University Counseling Center.