

ECE 2713

Digital Signals and Filtering

Spring 2024

TIME: TR 12:00 – 1:15 PM

PLACE: Sarkeys Energy Center, Room SEC A235

INSTRUCTOR:

Dr. J. P. Havlicek

DEH 333

Office Hours: TR 2:00 – 3:00 PM and by appointment

E-mail: joebob@ou.edu

ASSISTANTS:

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DEH 345

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TEXT & REFERENCES:

1. J. H. McClellan, R. W. Schafer, and M. A. Yoder, *DSP First*, 2nd ed., Pearson, Hoboken, NJ, 2016.
2. 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 for the details. 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).
3. I strongly recommend *Schaum's Outlines Mathematical Handbook of Formulas and Tables*. It is inexpensive and will serve you well for a lifetime.

COURSE WEB SITE: <http://coecs.ou.edu/Joseph.P.Havlicek/ece2713/>

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>

You will submit your homework and your Design Project electronically on Canvas. Some announcements will also be posted to the course Canvas page. Important information may also be distributed by Canvas notifications.

Canvas grading will **not** be used in this course. More information about grading is given later in this syllabus.

PREREQUISITES:

ENGR 1411 or ENGR 3511 or concurrent enrollment; CS 1313 or CS 1321 or CS 1323 or CS 1324 or concurrent enrollment; MATH 2423 or MATH 2924.

REASONABLE ACCOMMODATION POLICY:

The University of Oklahoma is committed to providing reasonable accommodation for all students with disabilities. Students with disabilities who require accommodations in this course are requested to speak with the instructor as early in the semester as possible. Students with disabilities must be registered with the Accessibility and Disability Resource Center prior to receiving accommodations in this course. The Accessibility and Disability Resource Center is located in the University Community Center at 730 College Avenue, (405) 325-3852 (Tel) or (405) 325-3494 (VP). The Accessibility and Disability Resource Center web site is located at <http://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://www.ou.edu/integrity>

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 digital signals and filtering. Students will learn fundamental techniques for modeling signals and systems using mathematics, for performing engineering analysis of signals and systems, and for designing simple FIR and IIR filters to process digital signals using MATLAB. Basic frequency domain concepts including discrete Fourier and z -transforms will also be covered.

HOW TO SUCCEED IN THIS CLASS:

It is **CRITICAL** that you pace yourself and **KEEP UP**. Don't put off assignments until the night before they are due. Instead, start each assignment early enough that you

can ask questions during class or office hours if you run into trouble or have questions. This will save you LOTS of time. If you start an assignment the night before it is due and you run into trouble, then you will have to stay up all night trying to figure out the answers to your questions. If you start early, then you can stop when you have problems and ask questions during class or office hours. This approach will minimize the total number of hours you spend on each assignment.

Try to LEARN DURING CLASS by participating in the lectures, both intellectually and vocally. Try to use your time outside of class to DRILL by working exercises. The homework assignments will be based primarily on the LECTURES. The tests and exam will be based primarily on the HOMEWORK.

If you keep up, then you should be able to understand the lectures and LEARN DURING CLASS. If you don't understand something in a lecture, then you should raise your hand and ASK QUESTIONS such as "I don't understand what you just said. It confuses me because..." DO NOT BE ASHAMED OR EMBARRASSED to ask questions!

HOMEWORK:

Homework will be assigned during class. 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.*

Some homework problems will require the use of MATLAB. The standards of academic honesty just articulated above apply to MATLAB problems as well. In addition:

- All computer codes and results that you turn in as solutions must be your own original work.
- **If** you obtain code 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 from another person in electronic or hardcopy format, type some or all of it in yourself, and then include this as part of the solution that you turn in, **then** *you are guilty of academic misconduct.*

Here are some **important** things about homework:

- ▶ Homework assignments will generally be due on Canvas at midnight on the published due date.
- ▶ For "paper and pencil" homework assignments, you will scan or photograph your solution and upload it to Canvas.
- ▶ For Matlab homework assignments, you will use a word processing program (e.g., WORD) to make a solution file which you will upload to Canvas.

- ▶ *Late homework will not be accepted* (see policy below).
- ▶ Your lowest **two** homework grades will be dropped. Medically excused homework assignments will also be dropped.
- ▶ Homework solutions will be posted on the course web site.

Working the homework problems on time will help YOU to do well on the tests and exam.

LATE HOMEWORK POLICY:

Late homework will not be accepted. There are two reasons for this policy. First, accepting a late homework assignment from one student is unfair to other students 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.

DESIGN PROJECT:

Near the end of the semester there will be a special Design Project. For the Design Project, you will use MATLAB to analyze real-world digital signals. Based on your analysis, you will then use MATLAB to design digital filters for processing the signals. The same standards of academic honesty articulated above for homework apply to the Design Project as well.

TESTS & EXAM:

There will be two tests and a cumulative final exam. The date and time for each test will be announced in class at least one week in advance.

The tests and the exam are CLOSED BOOK and CLOSED NOTES. Formula sheets will be provided with each test and exam. These same formula sheets will be made available on the course web site so that you can practice working problems using them. Calculator use will be required on the tests and exam – make sure to have a good full-featured engineering and scientific calculator.

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.

GRADING:

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

What	Value
Homework (lowest two dropped)	15%
Test One	20%
Test Two	20%
Design Project	20%
Final Exam	25%

These numerical grades will be converted into letter grades using a curve that will be determined by the instructor. 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. Math review
2. Mathematical representation of signals
3. Intro to MATLAB
4. Spectrum representation and LTI filters
5. Sampling and aliasing
6. FIR filters
7. Discrete-time Fourier transform and DFT
8. z -transform
9. IIR filters

GOOD LUCK!

REMEMBER TO PACE YOURSELF & KEEP UP!

REMEMBER TO LEARN DURING CLASS!

ASK QUESTIONS WHEN YOU DON'T UNDERSTAND!

USE OUTSIDE-CLASS TIME TO DRILL!

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 information is available through the Department of Campus Safety.

ADDITIONAL REQUIRED UNIVERSITY LEGAL & POLICY STATEMENTS...

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.