ECE 5273
Digital Image Processing
Spring 2021

TIME: TR 7:00 – 8:15 PM

PLACE: Video Conference; will meet via zoom

INSTRUCTOR:

Dr. J. P. Havlicek
DEH 333 (Office Hours will be online via zoom)
Office Hours: TR 2:30 – 3:30 PM and by appointment
E-mail: `joebob@ou.edu`

TEXT & REFERENCES:

1. "ECE 5273 *Digital Image Processing*" Lecture Notes Pack. The lecture notes will be made available on Canvas.
2. Recommended text: A. Bovik, *The Essential Guide to Image Processing*, Academic Press, Burlington, MA, 2009, ISBN 978-0-12-374457-9. This book has significant overlap with the course lecture notes. The examples are implemented in LabVIEW.
3. Recommended text: R.C. Gonzalez and R.E. Woods, *Digital Image Processing*, Prentice Hall, Upper Saddle River, NJ, 2007, ISBN 978-0-13-168728-8. Previous editions were published by Addison-Wesley with ISBN 0-201-50803-6. This is a classical comprehensive text on digital image processing.

COURSE WEB PAGE: `http://coecs.ou.edu/Joseph.P.Havlicek/ece5273/`

CANVAS: `http://canvas.ou.edu`

Video lectures, tests, and certain other information will be posted to the course Canvas page. You will also submit your assignments and test papers on Canvas.

PREREQUISITE:

ECE 3793, *Signals and Systems*, **or** elementary knowledge of the Fourier transform, the Fourier series, the discrete Fourier transform, and their use in linear system analysis.

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 Disability Resource Center prior to receiving accommodations in this course. The Disability Resource Center is located in the University Community Center at 730 College Avenue, (405) 325-3852 (Tel) or (405) 325-3494 (VP). The Disability Resource Center web site is located at `http://www.ou.edu/drc`.

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 clarifying the precise meaning of *academic misconduct* in this course is provided below.

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

COURSE DESCRIPTION:

This introductory graduate-level course provides an overview of the main concepts, results, and techniques that are the foundations of current academic research and industry practice in digital image processing.

HOMEWORK:

Homework will be assigned during class. Homework solutions will be posted on the course web page. 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*.

All computer codes and results that you submit in this course 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 formats and then type it in yourself and include it in the solution that you turn in, **then** *you are guilty of academic misconduct*.
- In certain cases, it may be acceptable to incorporate existing public domain and/or library computer algorithms and codes into a solution that you submit. In such cases, however, you must always obtain prior authorization from the instructor and you must always document the source of any algorithms and/or code that is not your own original work.

LATE HOMEWORK POLICY:

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

TESTS & EXAMS:

There will be two tests. There will NOT be a final exam. The Tests will be announced in class at least one week in advance. You may use calculators on the tests, but you may NOT use calculator programs.

The tests are OPEN NOTES. This means that you may bring a clean copy of the course lecture notes. **OTHER MATERIALS ARE NOT ALLOWED**. All work that you submit on your test paper must be your own; collaboration on a test constitutes a serious case of academic misconduct.

If you miss a test and your absence is NOT officially excused, then you will receive a zero grade. If you miss a test and your absence IS officially excused, then a makeup test will be given by arrangement with the instructor. Makeup tests may be written or oral at the discretion of the instructor.

TERM PROJECT:

A term project will be required of all students in the class. You will design your own term project. Written proposals for the term project will be due near the middle of the semester; the due date will be announced in class and posted on the course web site. A written progress report will also be due sometime between the proposal and the final project submission; the due date will be announced in class and posted on the course web site.

There is a required format for the written project proposal and written progress report; they are required to conform to the IEEE Signal Processing Society requirements for conference papers. More information on this requirement will be given in class.

The term project must involve significant creative activity and analysis or design. Look in recent journal articles and conference proceedings for ideas (analysis, extension, and implementation of a technique described in a published paper **do** constitute creative activity).

The term project should not simultaneously be used to satisfy requirements for another class unless advance permission is obtained from the instructor.

For substantial projects, joint or group work may be acceptable, but must be approved by the instructor in advance.

The standards of academic honesty given above for homework apply to the term project as well.

Project Suggestions:

- Development of new techniques.
- Extension of existing techniques.
- Simulation and analysis of existing techniques that yields new insight.
- Application of existing techniques to real-world image processing or machine vision problems.

COMPUTER USE:

Computer use will be required for the homework assignments and term project. You may use CoE computers or any other computer that you have access to. Use of C, C++, and/or Matlab are endorsed and recommended. Matlab will be required for some homework assignments. Instructions for how to install Matlab on your own computer are available on the "handouts" section of the course web site. 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).

GRADING:

Your final numerical grade will be calculated as shown in the following table.

What	**Value**
Homework	25%
Test I	20%
Test II	20%
Project Proposal	5%
Project Progress Report	5%
Term Project	25%

These numerical grades will be converted into letter grades using a curve determined by the instructor. The same curve will be applied to all students in the class. The curve will *never* hurt your grade relative to the ten-point scale.

COURSE OUTLINE:

1. Course Introduction, Image Types, Imaging Geometry, Image Acquisition, Imaging Devices, Image Representation.
2. Binary Image Processing.
3. Histogram, Point Operations, Algebraic & Geometric Image Operations.
4. Digital Fourier Transform, Sampling Theorem.
5. Convolution, Linear Filtering, Linear Image Enhancement, Linear Image Restoration (Deconvolution).
6. Nonlinear Image Filtering.
7. Introduction to Digital Image Analysis.
8. Digital Image Coding and Compression.