

AUBURN UNIVERSITY
Department of Electrical & Computer Engineering

ELEC 6430
Digital Image Processing
Spring 2012

Course Information

Professor: Stanley J. Reeves
Office: Room 221
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Web: <http://www.eng.auburn.edu/~reevesj/>

Class Hours: MWF 8:00 - 8:50 a.m.

Office Hours: TR 2:00–3:00 p.m., W 9:00–9:30 a.m., virtual office hours W 3:30–4:00 p.m., and other hours by appointment. I also encourage email contact at any time.

Teaching Philosophy:

A statement of my teaching philosophy can be found at <http://www.eng.auburn.edu/~reevesj/>.

Text: *Digital Image Processing*, 3rd ed., Gonzalez and Woods, Addison-Wesley, 2008. The lecture material will depart from the material in the book on a regular basis, so attendance and good notes are essential.

References:

Fundamentals of Digital Image Processing, A. K. Jain, Prentice-Hall, 1989.

Digital Image Processing, Castleman, Prentice-Hall, 1996.

Digital Image Processing, 2nd Ed., W. K. Pratt, Wiley, 1991.

Multidimensional Digital Signal Processing, D. E. Dudgeon and R. M. Mersereau, Prentice-Hall, 1984.

Two-dimensional Signal and Image Processing, J. S. Lim, Prentice-Hall, 1990.

Web Site: <http://www.eng.auburn.edu/~reevesj/Classes/ELEC6430>

Online material will be accessible via Instructure Canvas. (This is the Blackboard replacement that is being rolled out. You can access it via the big blue “C” icon at the top of AU Access or from the web site above.) Homework solutions and grades will be posted on Canvas.

Objectives:

This course introduces the fundamental principles and applications of digital image processing. The course lays a foundation in linear signals and system theory and digital signal processing and then explores major applications in image processing: enhancement, restoration, geometric transformations, color processing, and compression. Each student must carry out several hands-on computer assignments to complement the lecture material and a major project in one or more of the major topic areas.

Grading Policy:

Midterm	20%
Computer exercises	25%
Project preliminary report	5%
Project final report	20%
Final Exam	30%

Computer exercises:

Computer exercises will be assigned to complement and illustrate the lecture material. All exercises will be done using MATLAB. **Late exercises will not be accepted.**

Reference for Computer Exercises:

Beginning MATLAB for Engineers, S. J. Reeves. (available at Engineering Duplicating Services)
Kermit Sigmon, *MATLAB Primer*, 3rd edition, 1993. An online version can be found on the class web site. The primer is 39 pages.

Other online help is also available through this site.

The professor may sometimes post online lecture to supplement or replace a class meeting. In that case, a simple assessment quiz may be given to make sure students have watched the online lecture material. These quizzes will be averaged with the computer exercises, weighting each one as 10% of an exercise.

Homework:

Homework will be assigned occasionally but will not ordinarily be turned in. Solutions will be covered in class or distributed.

Computer Project:

Each student in ELEC 6430 is expected to do a programming project. The student may consult with the professor to decide on a topic. A short paragraph describing the essentials of the proposed project is **due on February 3**. Several possible project ideas will be mentioned in class. You may use any programming language you wish, but you are **strongly** encouraged to use MATLAB. If you choose to use a programming language or environment other than MATLAB, *you are on your own*.

The term project is intended to require approximately 30 hours of work and include a **significant** programming or experimental effort. Proposals for team projects will be considered for projects of greater scope as long as each individual is able to contribute approximately 30 hours.

A preliminary report is **due on March 2**. The preliminary report should contain a thorough literature review and/or preliminary code and experimental results.

At the end of the semester, each student will be responsible for a written and oral report describing the project and the results. More details will be posted on the class web site concerning the expectation for the project, the oral presentation, and the written report. **All projects are due on April 13**. Oral reports will begin that day.

Honesty Policy:

All out-of-class work is to be done **independently** and should represent your work alone. Sharing of programming tips and discussing general concepts is ok. Collaborating on experiments or code-writing is not. **Any** such collaboration on these assignments will be considered an act of dishonesty and will be treated accordingly.

Test Dates:

Midterm: March 7
Final: April 30, 8:00-10:30

Professionalism:

Students are professionals in training and should make every effort to take a professional approach to learning and classroom behavior. The following are specific areas of concern:

1. **Attendance:** Attendance is important and expected but not required. However, it is unprofessional behavior for a student to miss class without a valid excuse and then expect individual help or consideration from the instructor.
2. **Punctuality:** Professionals show respect to others in a meeting by being on time. Walking in late distracts the instructor and other students. Tardiness should be a rare event.
3. **Retrieving graded assignments:** Be sure to get your graded assignments when they are returned. If you miss a class in which assignments were returned, please see the instructor as soon as possible to pick yours up, either after class or in his office.
4. **Restroom:** The restroom is for use before and after class and for medical emergencies. Plan ahead!
5. **Talking in class:** Avoid obscene and profane speech. Exchanges with classmates during class should be quiet and related to the lecture. Stop talking when the instructor begins the class.
6. **End of class:** Do not rustle papers, slam books shut, snap three-ring binders, or shuffle around near the end of class. The instructor will work hard to end class on time, but the last few statements may be the most important of the entire class period. Do not distract yourself or others from hearing these.
7. **Laptops:** Laptops are encouraged but are to be used only for class purposes. Do not display anything that will distract others. Laptops are to be closed during quizzes and tests.
8. **Cell phones:** Cell phones should be in silent or vibrate mode and not answered during class apart from an emergency. Do not text in class or surf the web for information unrelated to the class.
9. **Personal audio devices:** These should be turned off and earphones removed during class.
10. **Spitballs:** Do not throw spitballs or put tacks in the instructor's chair. This is generally considered unprofessional behavior, except in Elbonia.

Students with Disabilities:

Students who need special accommodations are encouraged to see me after class or in my office as soon as possible so we can discuss your situation confidentially. You can contact me by phone or email if my office hours conflict with your schedule. Please bring your memo from The Program

for Students with Disabilities (PSD) to me as soon as possible; we can discuss it during your appointment. **Exam accommodations must be arranged at least one week in advance.** If at any time during the quarter you feel that the accommodations we have put in place are not working, please consult with me and/or the professional staff in the PSD office. If you do not have a memo from the PSD office that tells me about your accommodations, please make an appointment to see them in 1232 Haley Center (844-2096).

Contingency:

If normal class activities or computer lab availability are disrupted due to many students or the instructor experiencing illness or an emergency or crisis situation, the syllabus and other course plans and assignments may be modified to allow completion of the course. If this occurs, an addendum to your syllabus and/or course assignments will replace the original materials.

Topical Outline

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| 1. Introduction to digital image processing | (c) Coordinate conversion |
| (a) Definitions | (d) Color enhancement |
| (b) Image processing systems | 5. Geometric operations |
| (c) Image representation | (a) Pointwise interpolation |
| (d) Image capture & display | (b) Spatial transformations |
| (e) Visual perception | 6. Image restoration |
| 2. Signals and systems for image processing | (a) Degradation models |
| (a) 2-D continuous signals and systems | (b) Inverse filtering |
| (b) 1-D discrete signals and systems | (c) Weiner filtering |
| (c) 2-D discrete signals and systems | (d) Regularized restoration |
| 3. Image enhancement | 7. Image compression |
| (a) Histogram modification methods | (a) Differential coding |
| (b) Algebraic operations | (b) Quantization and adaptive bit allocation |
| (c) Spatial operations | (c) Transform coding |
| 4. Color | (d) Video coding |
| (a) Perception | |
| (b) Quantization | |