

AUBURN UNIVERSITY
Department of Electrical & Computer Engineering

ELEC 5430/6430
Digital Image Processing
Spring 2009

Course Information

Professor: Stanley J. Reeves
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Class Hours: MWF 8:00 - 8:50 a.m.
Office Hours: MT 2:00 - 3:00 p.m. and by appointment

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: I will link from Blackboard to an external class web site at <http://www.eng.auburn.edu/~reevesj/Classes/ELEC6430>
This will be used for several things:

- electronic presentation of computer assignments
- syllabus
- miscellaneous related info

Homework solutions and grades will be posted on Blackboard.

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 hands-on computer assignments to complement the lecture material in one or more of the major topic areas.

Grading Policy:

	5430	6430
Midterm:	25%	20%
Computer exercises:	35%	30%
Homework:	10%	0%
Computer project:	0%	20%
Final Exam:	30%	30%

Computer exercises:

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

Any feedback you may have about ways to improve MATLAB or the Image Processing Toolbox for MATLAB will be appreciated and passed along to some receptive developers at The Mathworks, Inc. If you have any problems at all with it, please let me know.

Reference for computer exercises:

Beginning MATLAB for Engineers, S. J. Reeves, College House Enterprises, LLC, 2001, 20 pp., which is available from Engineering Duplicating Services.

Note: An online primer can be found on the Engineering Sun Network under the Web Site. The primer is 39 pages. Other online help is also available through this site. **Please don't ask me MATLAB questions until you have read the online info provided.**

Homework:

Homework will be assigned occasionally but will not ordinarily be turned in. Solutions will be covered in class or distributed. 5430 students may be asked to turn in homework or do supplemental computer projects as part of the homework grade. 5430 students may choose to do a term computer project instead of homework.

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 02/04/09**. 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*.

At the end of the semester, each student will be responsible for a written and oral report describing his/her project and the results. More details will be given later concerning the format of the written report. **Projects are due on 04/15/09.**

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 4
Final:	May 7, 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 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.
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).

Topical Outline

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