

EE 533 - Digital Image Processing - 3 hours
Required Course

1. *2007-2008 Catalog description*
Design of computer-based imaging systems; multidimensional filtering and quantization methods for image enhancement, restoration, and pattern recognition.
Prerequisite: EE 302 or MATH 325.
2. *Prerequisites*
EE 302 or MATH 325, system representation, transfer functions, convolution, Fourier transforms, frequency response, random processes, probability density, autocorrelation, power spectral density
3. *Textbook(s) and/or other required material*
Required: "Digital Image Processing," Third Edition, by Rafael C. Gonzalez and Richard E. Woods, Pearson Prentice-Hall, 2002.
4. *Class/Laboratory Schedule*
Three class sessions per week, each 50 minutes, for 14 weeks
5. *Topics Covered (Outcomes influenced)*
 - Characteristics of imaging systems, sampling, aliasing (7a)
 - Image enhancement techniques, histograms, spatial filters (7a)
 - Two-dimensional convolution and two-dimensional transforms (7b)
 - Frequency domain techniques for image enhancement (7b)
 - Finite impulse response filter design (7c, 7d)
 - Properties of two-dimensional transforms (7c, 7d, 7e)
 - The two-dimensional fast Fourier transform (7d, 7e)
 - Frequency domain signal processing using the FFT (7d, 7e)
 - Medical Imaging (7f)
 - Multirate signal processing and applications to filtering, sub-band coding, and filter banks (7c, 7d, 7e)
 - Pattern recognition methodology (7c, 7d, 7f)
 - Issues in the construction of image processing systems, image processing software tools (7c, 7d, 7e, 7f)
 - Grading Policy and ECE Code of Conduct (7g)
6. *Contribution of course to meeting the curriculum components*
Engineering science - 66%, Engineering design - 34%.
7. *Course Outcomes (Program Outcome contributions): In learning the course topics, the student will attain the following outcomes*
 - a The student will be competent in describing discrete-time image signals and systems (9A, 9B)
 - b The student will understand the frequency domain description of discrete-time image processing (9A, 9B)
 - c The student will understand the design & specification of multi-dimensional digital filters for image processing applications (9C, 9D, 9F)
 - d The student will understand different approaches to the design and implementation of digital filters (9C, 9D)
 - e The student will gain proficiency in using simulation and design software tools, such as those found in Matlab (9C, 9D, 9F)
 - f The student will be aware of contemporary applications of image processing (9c, 9D)
 - g The student will understand the ECE Code of Conduct (9G)
8. *Grading policy and criteria*
Homework assignments will be collected and graded. In addition, individual problems may be assigned for classroom presentation. There will be a mid-term and a final exam and possibly a third exam.

Frequent homework assignments will be collected. NO LATE HOMEWORK without permission.

- Homework _____75 points
- Individual assignments and exams —150-200 points

A grade of C corresponds to meeting the minimum competency required to understand course topics and attain course outcomes.

Warning: An unexcused absence will earn you a zero for that assignment. In addition, cheating will be dealt with as described in the *Academic Handbook*. The ECE Faculty has established the ECE Student Code of Conduct based on well known requirements of academic integrity as well as the ethical and professional conduct expected of an engineer. The ECE student code is attached to this document and also appears on Blackboard.

9. *Relationship of course to program outcomes*

label	Program Outcomes (A Graduate from the program will:)	Contribution
A	have knowledge of the mathematical and scientific foundation of electrical engineering	Strong
B	have knowledge of and the ability to apply techniques and technology of electrical engineering	Strong
C	complete a design project sequence, culminating in a capstone project at or near the professional level	Foundational
D	understand that acquisition of new knowledge is needed for success in the electrical engineering profession	Moderate
E	meet Bradley's general education requirements which are based on the principles of liberal education	NA
F	have experience in communicating technical information and working on teams	Foundational
G	understand the importance of professional and ethical behavior	Moderate

10. *Prepared by:* Thomas L. Stewart, July 25, 2008.