

## EE/CMPEN 455 – Digital Image Processing I

**Designation:** EE elective course for electrical and computer engineering majors.

**University Bulletin Description:** EE/CMPEN 455: (3) Overview of digital image processing techniques and their applications; transforms, enhancement, analysis, segmentation, compression, color image processing; computer projects.

Prerequisites: EE 350, CMPSC 201 or CMPSC 121. Prerequisite or Concurrent: MATH/STAT 418

### Prerequisites by Topics:

1. Linear systems theory
2. Fourier transforms
3. Analytical geometry
4. Elementary probability theory
5. Good programming skills

### Textbook/Required Materials:

*Digital Image Processing*, 3<sup>rd</sup> Ed., R. C. Gonzalez and R. E. Woods, Prentice Hall, 2008.

### Learning Outcomes:

Introduce fundamental principles and techniques for digital image processing; provide hands-on experience in using software tools for processing digital images; implement image processing algorithms in software.

### Topics:

1. Introduction to concepts of digital image processing and their applications
2. Digital Image Fundamentals; image sampling and quantization
3. Image Enhancement; histogram processing; image smoothing and sharpening
4. Image Transforms; spatial frequency concepts; Fourier transform and its fast implementation
5. Image Analysis and Segmentation; morphological image processing.
6. Color image processing; color solids; RGB and HIS representation; enhancement
7. Image Compression; lossless and lossy compression, Hamming and Huffman codes, JPEG/MPEG

### Class/laboratory schedule:

Two lectures per week with each lecture being 75 minutes.

Laboratory: Students work in a computer laboratory on their projects on their own schedule

### Computer Usage:

### Laboratory Projects/Assignments:

### Contribution to Meeting the Requirements of Criterion 5. Curriculum:

This course contributes to both the engineering topics and design components.

It is frequently also taken by students from many other disciplines who would like to apply image processing methods in their field. The course introduces fundamental principles of image processing for image enhancement, restoration, analysis and compression. This is a hands-on course with students implementing principles that are discussed in class as computer algorithms, demonstrate their working program to the teaching assistant on a set of test images and interpret results. Students are encouraged to work in teams of up to three. This course complements the course EE/CMPEN 486 on Computer Vision.

### Relationship to Program Outcomes

O.1.1. Graduates will possess mathematics skills necessary for electrical engineering.

- O.1.3. Graduates will have attained computer proficiency.
- O.2.5. Graduates will have knowledge of digital systems.
- O.3.1. Graduates will have in-depth technical knowledge in one or more areas of specialization.
- O.3.2. Graduates will have practical understanding of the major electrical engineering concepts and demonstrate application of their theoretical knowledge of the concepts.
- O.4.2. Graduates will develop an appreciation of continuing educational and professional development.
- O.5.1. Graduates will have good teamwork skills.
- O.5.2. Graduates will possess good oral and written communication skills.

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