

# Master Course Description

**No:** EE 475

**Title:** DIGITAL IMAGE PROCESSING (DIP)

**Credits:** 3

**Catalog Description:** The course is designed for the senior undergraduate students. It will introduce the concepts related to digital images, provide insight into basic digital image processing operations and introduce the basic algorithms used for such purposes.

**Coordinator:** Burak Acar, Ph.D., Assistant Professor of Electrical Engineering

**Goals:** Its goals are to *i*) to introduce digital images (image acquisition, sensing, digital image representation), *ii*) to introduce principal DIP operations like enhancement, restoration, etc., *iii*) to present the basic / most popular DIP algorithms, *iv*) to provide practical skills for the implementation of such processes, *v*) to establish an insight how they are used in real-life problems.

## Learning Objectives:

At the end of this course, the students will develop skills regarding the basic image processing tasks. Specifically, they will:

1. get acquainted with digital image acquisition and representation
2. learn the principal DIP system components
3. learn how we perceive images
4. be able to choose / design / implement a basic DIP system with the enhancement, restoration, segmentation and compression steps as required

**Textbook:** *Digital Image Processing*, Rafael C. Gonzalez and Richard E. Woods, Second Edition, Prentice-Hall, 2001.

## Reference Texts:

1. Forsyth & Ponce, *Computer Vision: A Modern Approach*, Prentice Hall, 2003.
2. Wang, Ostermann & Zang, *Video Processing & Communications*, Prentice Hall, 2002
3. *Digital Image Processing with Matlab*, Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, First Edition, Prentice-Hall, 2004.

## Prerequisites by Topic:

1. Linear algebra
2. Signals and Systems
3. Programming skills

## Topics:

- Principal components of a digital image processing system
- Digital image fundamentals: Perception, acquisition, representation
- Digital image enhancement: Spatial and frequency domain filtering
- Digital image restoration: Image degradation and restoration models. Inverse, wiener and constrained least squares filtering
- Digital image compression
- Morphological operations
- Digital image segmentation: Discontinuity (eg. edge) detection, thresholding, region-based techniques, Watershed transform, etc.

**Course Structure:** The class meets for three lectures a week, each consisting of two 50-minute sessions. 6-7 problems will be assigned. They will primarily be Matlab assignments in the form of implementing the algorithms covered in class. Attendance to lectures is strongly encouraged but not obligatory.

**Computer Resources:** The course material, whenever needed, will be distributed through the CIMS system. <http://www.cims.ee.boun.edu.tr> and/or [www.vavlab.ee.boun.edu.tr](http://www.vavlab.ee.boun.edu.tr)

**Laboratory Resources:** The Matlab tutorials and the 3<sup>rd</sup> reference textbook.

## Grading:

1. Written Exam (30%)
2. Term Project (30%)
3. Computer Assignments (40%)

## Outcome Coverage:

*(a) Apply math, science and engineering knowledge.*

*(c) Design a system, component or process to meet desired needs.* The students will need to consider all of the DIP tools and concepts they are introduced to design a complete DIP system for the assignments they will be given. The choice of the system components, each component's specific settings, etc. will need to be determined to get the desired results.

*(e) Identify, formulate and solve engineering problems.* In parallel with the above items, the course will give the students the ability to see real life problems in terms of the knowledge they have and transform the problem into the technical language and apply their knowledge to solve it.

*(k) Use the techniques, skills and modern engineering tools necessary for engineering practice.* The assignments will not only be graded on a theoretical basis but also on the quality of the end product. This depends on the students' ability to use current engineering tools, preferably in Matlab environment.

**Prepared By:** Burak Acar

**Last revised:** September 01, 2004