COURSE PROFILE

Course Number : EE453	**Course Title :** Introduction to Image Processing
Required / Elective : Elective	**Pre-requisite :** EE350
Catalog Description: 2-D sampling, aliasing, and quantization. Fundamentals of color science, human visual system. 2-D Block transforms, DFT, DCT and wavelet transforms. Image filtering, edge detection, enhancement, and restoration. Inverse problems and tomographic reconstruction. Image analysis including color and texture segmentation. Image compression.	**Textbook / Required Material :** "Digital Image Processing" by Rafael C. Gonzalez and Richard E. Woods, 3rd Edition (International Ed.), Prentice Hall.

Course Structure / Schedule : (3+0+0) 3 / 6 ECTS

Extended Description:

The goal of this course is to introduce students to some fundamental concepts associated with digital image processing. In particular, the course covers a wide range of image processing topics, from enhancement, restoration to compression, segmentation, etc., and related practical application areas. In this manner, we aim to provide a leveraged perspective of theoretical analysis and practical aspects of current digital image processing systems. Also, the course is designed in a way to provide students with essential design and programming skills through extensive use of MATLAB.

Design content:	**Computer usage:**
Selecting the design parameters for optimal performance of related image processing systems; designing and integrating enhancement and restoration techniques for different applications; integrating different coding tools and selecting the related coding parameters for efficient lossless and lossy image compression; designing simple object segmentation and recognition algorithms.	Homework problems require the use of MATLAB®.

Course Outcomes: [relevant program outcomes in brackets]:

a. Ability to apply knowledge of mathematics and linear systems to problems in image processing [2].

   Relevant Content: 2-D signal processing, Fourier Transform, DFT, sampling theory, convolution and filtering; modeling of image and noise using random processes; entropy, bitrate and PSNR computations;

b. Ability to recognize the needs and challenges of our age, and to assess the global and social impacts of image processing solutions [3].

   Relevant Content: Basic understanding of the widespread use of digital imaging systems; the need for effective use of scarce resources such as storage and bandwidth, and ways to provide that effective use by data compression; social impacts and applications of object recognition systems, such as in security, entertainment and automation fields.

c. Ability to identify, formulate and solve image processing problems [6].

   Relevant Content: Modeling of digital images and degradations such as noise and motion blur; derivation of conditions for optimal filtering, thresholding, coding and classification of images; analyzing and evaluating the performance of image enhancement, restoration and coding algorithms through the use of both subjective and objective metrics; identifying the source of redundancy in images and exploiting this redundancy for developing efficient coding techniques.

d. Ability to design and integrate components of image processing systems to satisfy given requirements [7].

   Relevant Content: Selecting the design parameters for optimal performance of related image processing systems; designing and integrating enhancement and restoration techniques for different applications;

integrating different coding tools and selecting the related coding parameters for efficient lossless and lossy image compression; designing simple object segmentation and recognition algorithms.

e. Ability to use the software based modeling, simulation, and design tools necessary for practical image processing applications [11].

Relevant Content: Design and implementation of image enhancement, restoration, coding, and transformation algorithms in MATLAB.

Level of contribution of course to program outcomes:
Strong: 2, 6, 11
Average: 7
Some: 3

Recommended reading:

"Digital Image Processing Using MATLAB®," by Rafael C. Gonzalez and Richard E. Woods, and Steven L. Eddins, Prentice Hall.
"Fundamentals of Digital Image Processing," by A.K. Jain, Prentice Hall.
"Digital Image Processing, " by W.K. Pratt, 3rd ed, Wiley-Interscience, 2001.

Teaching Methods:

Exams, homework, programming projects

Assessment Methods: [Related to course objectives]

- Exams: {a, b, c}
- Portfolios (homework, programming projects): {d, e}
- Class surveys: {b}

Student Workload:

Preparatory reading	15 hrs
Lectures, discussions	45 hrs
Analytical Homework	15 hrs
Programming Projects	35 hrs
Exam Preparation (Problem Sets)	35 hrs
Exam	5 hrs
**TOTAL ……	**150 hrs … to match 25 x 6 ECTS**

Prepared by : Assist. Prof. Hasan Fehmi Ateş	Revision Date : 19.04.2010