<table>
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<tr>
<th>Course name</th>
<th>ECE 54800 Introduction to 2D &amp; 3D Digital Image Processing (ECE 595)</th>
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<tbody>
<tr>
<td>Credit and contact hours</td>
<td>(3 cr.) Class 3</td>
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<tr>
<td>Course coordinator’s name</td>
<td>Paul Salama</td>
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**Course information**

2014-16 IUPUI Campus Bulletin description:
ECE548 Introduction to 2D and 3D Digital Image Processing (3 cr.) Class 3. An introduction to 2D and 3D image processing. Lecture and projects covering a wide range of topics including 2D and 3D image analysis, image segmentation; color image processing, image sharpening, linear and filtering, image restoration, and image registration.

**Prerequisites/ Co-Requisite**
ECE30100 or Graduate Standing

**Required, Elective, or Selected Elective:**
EE Elective, CE Elective

**Goals for the course**

Upon successful completion of the course, students should be able to
1. Determine the frequency content of discrete time and discrete space signals. [a, b]
2. Apply different image enhancement methods to enhance blurred images. [a, b, c, e]
3. Apply different image filtering schemes to enhance noisy images. [a, b, c, e]
4. Apply different schemes to segment images. [a, c, e]
5. Obtain the optimal transformation for image registration. [a, c, e]
6. Extract depth information from image sequences. [a, c, e]

**List of topics to be covered**

1. Mathematical Foundation for Digital Image Processing:
   - 1D Discrete Space Fourier Transform (1D-DSFT)
   - 1D Discrete Fourier Transform 1D-(DFT)
   - 2D Discrete Space Fourier Transform (2D-DSFT)
   - 2D Discrete Fourier Transform (2D-DFT)
2. Image Enhancement, Restoration, and Filtering:
   - Histograms and Point-wise Operations
   - Spatial Filtering - 2-D Finite Impulse Response Filters (FIR) and Infinite Impulse Response (IIR)
   - Sharpening Filters – Un-sharp Mask
   - Frequency Domain Filtering
   - Contrast and Color Enhancement
   - Red-eye Detection (Flash Effect on Cornea)
3. Image Registration: Multi-Image Registration Using Rigid Body Transformations

4. Image Segmentation:
   - Edge Detection – Laplacian of Gaussian (LoG), Canny, 1st Order Operators
   - Thresholding – Local, Global
   - Morphological Operations – Binary
   - Hough Transform

5. 3D Image Processing:
   - 3D DSFT and 3D Filtering
   - 3D Volume Rendering and Visualization - Medical Images
   - 3D depth information from defocus
   - 3D display technologies
   - 4D Extensions (3D plus time)

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<tr>
<th>Syllabi approved by</th>
<th>Paul Salama</th>
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<td>Date of approval</td>
<td>02/20/2016</td>
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