Course Name:	**Introduction to 2D & 3D Digital Image Processing**
Credit and contact hours:	(3 cr.) Class 3
Course coordinator's name	Paul Salama
Textbook	Kenneth Dawson-Howe, A Practical Introduction to Computer Vision with OpenCV, Wiley, 2014, ISBN 9781118848456.
Course Information	ECE 548 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/ CoRequisite** ECE301 or Graduate Standing **Indicate whether a required, elective, or selected elective course in the program**
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 [1,6] 2. Apply different image enhancement methods to enhance blurred images. [1,2,6] 3. Apply different image filtering schemes to enhance noisy images. [1,2,6] 4. Apply different schemes to segment images [1,2,6] 5. Obtain the optimal transformation for image registration [1,2] 6. Extract depth information from image sequences [1,2]
List of topics to be covered	1. Mathematical Foundation for Digital Image Processing: a) 1D Discrete Space Fourier Transform (1D-DSFT) b) 1D Discrete Fourier Transform 1D-(DFT) c) 2D Discrete Space Fourier Transform (2D-DSFT) d) 2D Discrete Fourier Transform (2D-DFT) 2. Image Enhancement, Restoration, and Filtering: a) Histograms and Point-wise Operations b) Spatial Filtering - 2-D Finite Impulse Response Filters (FIR) and Infinite Impulse Response (IIR) c) Sharpening Filters – Unsharp Mask d) Frequency Domain Filtering e) Contrast and Color Enhancement f) Red-eye Detection (Flash Effect on Cornea) 3. Image Registration: Multi-Image Registration Using Rigid Body Transformations

	4. Image Segmentation:
	   a) Edge Detection – Laplacian of Gaussian (LoG), Canny, 1st Order Operators
	   b) Thresholding – Local, Global
	   c) Morphological Operations – Binary
	   d) Hough Transform
	5. 3D Image Processing:
	   a) 3D DSFT and 3D Filtering
	   b) 3D Volume Rendering and Visualization - Medical Images
	   c) 3D depth information from defocus
	   d) 3D display technologies
	   e) 4D Extensions (3D plus time)

Syllabi Approved by	Paul Salama
Date of Approval	11/12/2021