1. Course Number and Name: 410 CPE – Digital Image Processing and Vision

2. Credits and Contact Hours: 3 Credit

a. Lecture – 2 day per week at 50 minutes for 16 weeks
b. Laboratory – 1 day per week at 100 minutes for 16 weeks

3. Course Coordinator or Instructor:

Dr. Ahmed Said Badawy

4. Text Book:

- William K. Pratt - Digital Image Processing - Third Edition 2001.
- Rafael C.Gonzalez, RichardE.Woods, Digital Image Processing, 2nd Edition, Prentice Hall, 2002.
- Mark Nelson, Jean-Loup Gailly "The Data compression Book" 2 Ed, 2004.

5. Specific Course Information:

a. **Catalog Description:** Image processing fundamentals, image analysis and understanding, and machine vision applications.
b. **Prerequisites:** 311 CPE Software Engineering
c. **Status:** Required

6. Specific Goals for the Course:

a. Course Outcomes:

1. Define the fundamental principles of techniques Image Processing and describe the different algorithms for digital image processing in both spatial domain (point to point, and area to point); and frequency domain.
2. Describe the need of image processing application in the job market.
3. Develop an ability to pick out and direct the proper image-processing algorithm for a specific demand and explain coding algorithms for image compression problems.
4. Explain key impact of digital image processing solutions in a global and economic context.
5. Demonstrate and ability to work within a team.
6. Illustrate how to search the internet to deal with image processing problems.
7. Demonstrate the necessary skills to communicate, listen, discuss and evaluate their strengths and weaknesses in the class.

b. Student outcomes in Criterion 3 addressed by course:

Course LOs #	Map course LOs with the program LOs. (Place course LO #s in the left column and Student LO #s across the top.) Student Learning Outcomes Use LOs Codes											
	a1	a2	b1	b2	b3	b4	c1	c2	c3	c4	d1	d2
1	√											
2		√										
3			√									
4						√						
5								√				
6										√		
7												√

7. List of Topics: 410 CPE – Digital Image Processing and Vision

List of Topics for Theory:

- **Introduction:** Representation of an Image, - elements of visual perception - simple image formation model – Digital Image processing, Levels of Image Processing, History of Image processing, Applications of Image processing, Basic relationship between pixels,Adjacency,Types of Adjacency, connectivity, Fundamental Steps in Digital Image Processing, Types of Images, Data –Type Conversions,
- **Image Improvement:** Image enhancement - Spatial domain methods - point processing - intensity transformations, image subtraction, image averaging. Thresholding, Contrast Enhancement, Inverse Log, ,Identity Functions, Image Negative Functions, Spatial Resolution, Reducing Spatial Resolution Power-Law Transforms, Log Transforms histogram processing
- **Transformations and Frequency Domain Filtering:** Image transforms - 1D-DFT,2D-DFT, FFT, Ideal Low pass Filters Ideal Low pass Filters, Ideal High Pass filters
- **Image Compression:** fundamentals- redundancy, coding, inter pixel, Models, Elements of information theory, Error free compression- variable length, bit plane,. Fundamentals of JPEG Compression.
- **Image Restoration:** Filtering in spatial Domain, Salt and Pepper Noise, Image restoration and Degradation model -mean filter, median filter, alpha-trimmed filter. Geometric transformations. Fundamentals of Color image processing: color models - RGB, CMY, YIQ.
- **Image Segmentation:** Detection of discontinuities - point, line and edge and combined detection, Edge linking and boundary detection.

List of Topics for Laboratory:

- Introduction to Sherlock,Inspect and Sapera and MATLABSoftware and Camera installation settings,camera adjustments, how to capture image
- Neighborhood pixels processing.
- Image types,read,write and display image.
- Implementation of Image Add,Sub,Neg,Resize,Thresholding.
- Histogram Equalization of an Image.
- Implementation of Log transforms, Power transforms of an Image.
- Understanding FFT,DCT Filters and using FFT for implementing filters
- Detecting Circles, faults in given image using Sherlock Software.
- Implementation of image compression
- Detecting Edges and faults in a given sequence of images using Sherlock
- Salt and pepper noise Addition and image Reconstruction using median filter