COURSE DESCRIPTION

Course Name:	**Image Processing Techniques**
Course Code:	10B1WCI737
Course Credits:	3 (3-0-0)
Branch and Semester:	B.Tech – 7th Semester (CSE/IT/ECE)
Session:	July – December, 2016
Faculty Coordinator:	Dr. Amit Kumar Singh

Pre-requisites: Linear algebra, Matrices, Matrix Operations, Determinants, Systems of Linear Equations, Eigen values, Eigenvectors, Statistics and probability, Programming experience, preferably in matlab, and/or C/C++/C#/Python/Java

Objective: The aim of the course is to introduce the student to various image processing techniques. The student learns about image fundamentals, describes the main characteristics of digital images, how they are represented, mathematical transforms such as such as Fourier, Cosine transforms, Singular value decomposition, 2D Wavelet transform, image enhancement techniques, Image restoration and denoising, segmentation, lossy and lossless data compression algorithms, binary and color image processing. The student will be exposed to dealing with image data through programming assignments using matlab, and/or C/C++/C#/Python/Java.

Learning Outcome:

Upon completion of this course, a successful student should be able to design and implement programs that deal with image data.

- To understand how digital images are represented, manipulated, encoded and processed, with emphasis on algorithm design, implementation and performance evaluation.
- Emphasis will be to develop engineering skills and intuitive understanding of the tools used in Image Processing.
- The students would be encouraged to design and develop the image processing algorithms/tools to real life problems.

Course contents:

S. No.	Topic	L
1	**Introduction to Digital Image Processing** Introduction to images and its processing, Components of image processing systems, image representations, Image file formats, Applications of digital image processing, image sampling and quantization, Image Analysis, Intensity transformations, contrast stretching, Correlation and convolution, Smoothing filters, sharpening filters, gradient and Laplacian.	5
2	**Image Transformation Techniques** Need for transform, Fourier, Cosine transforms, Haar, KL Transform, Singular value decomposition, 2D Wavelet transform, Different properties of image transform techniques.	7
3	**Image Compression Basics** Concept of image compression, lossless techniques (Huffman Coding, Arithmetic and Lempel-Ziv Coding, Other Coding Techniques) and lossy compression techniques (Transform Coding & K-L Transforms, Discrete Cosine Transforms, and BTC), Multi-Resolution Analysis, and Still Image Compression Standards (JBIG and JPEG),	7
4	**Image Enhancement** Enhancement in spatial and transform domain**,** histogram equalization DirectionalSmoothing, Median, Geometric mean, Harmonic mean, Cont raharmonic mean filters, Homomorphic filtering,Color image enhancem ent.	5
5	**Image Restoration and Denoising** Image degradation, Type of image blur, Classification of image restoration techniques, ,image restoration model, Linear and non linear restoration techniques, Image denoising, Median filtering	5
6	**Image Segmentation** Classification of image segmentation techniques**,** Boundary detection based techniques, Point, line detection, Edge detection, Edge linking, local processing, regional processing, Hough transform, Thresholding, Iterative thresholding, Otsu's method, Moving averages, Multivariable thresholding, Region-based segmentation, Watershed algorithm, Use of motion in segmentation	5
7	**Binary and Color image processing** Binarization, Basic Set theory, Binary morphological operations and its properties, Color Image Representation in MATLAB, Converting Between Color Spaces, The Basics of Color Image Processing, Color Transformations, Spatial Filtering of Color Images, Working Directly in RGB Vector Space	5
8	**Image Processing Applications:** Case studies	6
	Total Hours	**45**

Evaluation Scheme:

S.No	Exam	Marks	Duration	Coverage/Scope of Examination
1	Test -1	15	1 hr.	Syllabus covered up to Test- 1.
2	Test -2	25	1.5 hr.	Syllabus covered up to Test- 2.
3	Test -3	35	2 hr.	Complete Syllabus.
4	Assignments/Homework/Small Projects (5), Quizzes (5), Regularity in Attendance (5), Researching and presenting a technology review topic (10)	25	Entire Semester	5+5+5+10
	TOTAL =	**100**		

Recommended Books

1. Digital Image Processing, R.C. Gonzalez and R.E. Woods, 2nd edition, Pearson Prentice Hall, 2008
2. Anil K. Jain, *Fundamentals of Digital Image Processing*, Prentice Hall, 1989.
3. Digital Image processing, S Jayaraman, TMH, 2012
4. William K. Pratt, *Digital Image Processing*, 3rd Edition, John Wiley, 2001.