

		Theory	Pract.	Tut.	Theory	TW/Pract	Tut.	Total
BEITC7051	Image Processing	04	02	---	04	01	---	05

Course Code	CourseName	Examination Scheme						Total	
		Theory Marks				TW	Pract.		Oral
		Internal Assessment			End Semester Exam				
BEITC7051	Image Processing	Test 1	Test 2	Average of Test1 & Test2		End Semester Exam			
		20	20	20	80	25	---	25	150

Course Pre-requisite: As images are two dimensional signals, the single dimensional Digital Signal Processing fundamentals are part of the prerequisite study.

Objective: One picture is worth thousand words. A course in digital image processing teaches how such visual information can be used in various applications. This course will introduce the basic ideas and techniques used for processing images and their popular applications.

The objectives of this course are:

- To cover the basic theory and algorithms that are widely used in digital image processing,
- To expose students to current technologies and issues that are specific to image processing systems
- To develop skills in using computers to process images.

Outcome: Students should demonstrate the ability:

- To understand the fundamental concepts of a digital image processing system,
- To make extensive use of these concepts in implementing processing techniques such as noise removal, enhancement, compression for efficient storage and transmission, object extraction, representation and description for recognition or building computer vision, etc.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	Weightage of marks
0	Introductions to Signal Processing Only as a prerequisite for Image Processing. Hence not part of theory exam.	Analog, discrete and digital signals, 1D, 2-D signals with examples. Discrete time signals: sequences, Discrete time systems LTI systems and their properties. Convolution and Correlation- need, methods and examples	04	0%
1	Introduction to digital image processing	Introduction: Definition of digital image, generation of digital image, steps in digital image processing, 2D sampling, spatial and tonal resolutions, pixel connectivity, elements of digital image processing systems	05	10%
2	Image enhancement in the spatial domain	Point operations, histogram processing, spatial filtering: smoothing, sharpening, median, highboost	07	20%
3	Two Dimensional Discrete Fourier Transform	Introduction to image in frequency domain, Concept of basis images, two dimensional D.F.T. and its properties, two dimensional F.F.T. Filtering in the frequency domain: smoothening, sharpening and homomorphic filtering.	06	15%
4	Image segmentation	Detection of discontinuities, edge linking and boundary detection, Hough transform, thresholding, region oriented segmentation.	06	10%
5	Image representation and description	Boundary descriptors: shape number, Fourier descriptor, statistical moments; regional descriptors	06	10%
6	Image data compression	Image data redundancies: coding, inter-pixel, psychovisual; Fundamentals of lossless compression : Arithmetic coding, Huffman coding, LZW coding, RLE, Bit plane coding, predictive coding Lossy compression : JPEG, Subband coding, Vector quantization, Image compression standard, Fidelity criteria	06	15%
7	Image morphology	Morphological operation : Dilation erosion, Opening & Closing, Hit or Miss Transform, Basic Morphological Algorithms	04	10%

8	Applications of image processing	Case Study on the following applications: Digital watermarking, Biometric authentication (face, finger print, signature recognition), Vehicle number plate detection and recognition, Content Based Image Retrieval, Text Compression.	04	10%
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Text Books:

1. Gonzalez & Woods, Digital Image Processing, Pearson Education, Third Edition.
2. W. Pratt, Digital Image Processing, Wiley Publication, Fourth Edition, 2013.

Reference Books:

1. J. G. Proakis and D. G. Manolakis, Digital Signal processing Principals, Algorithms and Applications, PHI publications, Third edition,
2. Milan Sonka , Digital Image Processing and Computer Vision, Thomson publication, Second Edition.2007.
3. A.K. Jain, Fundamentals of Image processing, Prentice Hall of India Publication, 1995
4. Gonzalez & Woods, Digital Image Processing using MATLAB, Pearson Education
5. S.Jayaraman, S Esakkirajan and T Veerakumar, Digital Image Processing ,McGraw Hill Education (India) Private Limited, New Delhi, 2009.
6. S.Sridhar, Digital Image Processing ,Oxford University Press, New Delhi, 2011.

Term work:

At least 08 experiments covering entire syllabus must be performed during the semester and it should be presented in the practical record. Term work assessment must be based on the overall performance of the student with every practical graded from time to time. The grades should be converted into marks as per the Credit and Grading System manual and should be added and averaged. Due weightage should be given for the student's attendance.

Internal Assessment (IA):

Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the tests shall be considered as final IA marks

Suggested Practical List:

A minimum of 8 experiments from the suggested list must be performed. The DSP experiments (experiment 1 and 2) are the prerequisites.

1. Write a MATLAB program or C++ program for generating the following discrete time signals:
 - a. Exponential signal
 - b. Unit step and unit ramp signals
 - c. Sinusoidal signal
 - d. Composite signal with minimum 3 sinusoids added
2. Write a MATLAB program to demonstrate convolution and correlation operations with different examples of discrete time sequences.
3. Write a program for the following point processing operations and compare the results with MATLAB built in functions
 - a. Image negative
 - b. Gray level slicing with or without background
 - c. Power law transformations
 - d. Bit plane slicing
 - e. Histogram equalization
4. Write a program for image enhancement and compare the results with MATLAB built in functions.
 - a. Smoothing
 - b. Sharpening
 - c. High boost filtering
5. Write a program for image noise removal and analyze the results using,
 - a. Averaging
 - b. Median filter
6. Write a MATLAB program for 2D Discrete Fourier Transform and Inverse transform using built in functions.
7. Write a MATLAB PROGRAM for Transform domain processing using low pass and high pass filters and analyze the results for the following (any one):
 - a. Ideal filter
 - b. Butterworth filter
 - c. Gaussian filter
8. Write a MATLAB PROGRAM for edge detection in 2 directions and compare the results with built in functions for the following operators (any one):
 - a. Robert operator
 - b. Prewitt operator
 - c. Sobel operator
9. Write a MATLAB PROGRAM to compress the image using any one of the following lossless image compression techniques:
 - a. Huffman
 - b. RLE
 - c. LZW
10. Write a MATLAB PROGRAM to compress the image using any one of the following

lossy image compression techniques:

- a. JPEG
 - b. IGS
 - c. Predictive coding
11. Write a MATLAB PROGRAM to perform the following basic and derived morphological operations:
- a. Dilation
 - b. Erosion
 - c. Opening
 - d. Closing
 - e. Boundary Detection
12. Write a MATLAB PROGRAM to represent / describe the image using any one of the following:
- a. Chain code / shape number
 - b. Moments
 - c. Fourier descriptors
 - d. Euler number

Theory Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total 4 questions need to be solved.
3. Q.1 will be compulsory, based on entire syllabus wherein sub questions of 2 to 3 marks will be asked.
4. Remaining question will be randomly selected from all the modules.

Weightage of marks should be proportional to number of hours assigned to each module.