Academic Course Description

BHARATH UNIVERSITY
Faculty of Engineering and Technology
Department of Electronics and Communication Engineering

BEC007– DIGITAL IMAGE PROCESSING

Seventh Semester

Course (catalog) description

The course considers Digital image processing and techniques. In this course, we will introduce some of the basic mathematical concepts that will allow us to think in the two "domains" of Image Processing, the time domain and the frequency domain. The course covers the basic types of digital images from both a mathematical description and from a block-diagram system approach.

Compulsory/Elective course: Elective for ECE students

Credit hours : 3 credits

Course Coordinator : Mr.B.Karthik, Asst. Professor, Department of ECE

Instructor(s) :

Name of the instructor	Class handling	Office location	Office phone	Email (domain: @bharathuniv.ac.in)	Consultation
Mr.B.Karthik,	IV ECE	SA 006		Karthik.ece	12.30-1.30 PM

Relationship to other courses

Pre-requisites : Nil

Assumed knowledge : The students will have a physics and mathematics background obtained at a high school (or equivalent) level. In particular, working knowledge of basic mathematics including differentiation, integration and probability theories are assumed.

Following courses : Nil

Syllabus Contents

UNIT I DIGITAL IMAGE FUNDAMENTAL **9**

Elements of digital image processing systems, Elements of Visual perception, Image sampling and quantization, Matrix and Singular Value representation of discrete images.

UNIT II IMAGE TRANSFORMS **9**

1D DFT, 2D DFT, Cosine, Sine Hadamard, Hear, Slant, KL, SVD transform and their properties.

UNIT III IMAGE ENHANCEMENT **9**

Histogram – Modification and specification techniques Image smoothing, Image sharpening, generation of spatial masks from frequency domain specification, Nonlinear filters, Homomorphism filtering, false color, Pseudo color and color image processing.

UNIT IV IMAGE RESTORATION AND RECOGNITION **9**

Image DEGRADATION models, Unconstrained and Constrained restoration, inverse filtering, Least mean square filter, Pattern Classes, optimal statistical classifiers, Neural networks and associated training methods and use of neural networks in image processing.

UNIT V IMAGE COMPRESSION **9**

Run length, Huffman coding, Shift codes, arithmetic coding, bit plane coding, transform coding, JPEG Standard, wavelet transform, predictive techniques, Block truncation coding schemes, Facet modeling.

Total : 45 Periods

TEXT BOOK:

1.Rafael C. Gonzales, Richard E. Woods, "Digital Image Processing", Third Edition, Pearson Education, 2010

REFERENCES:

1.Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Third Edition Tata Mc Graw Hill Pvt. Ltd., 2011.

2. Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning Pvt. Ltd., 2011.

3.Willliam K Pratt, "Digital Image Processing", John Willey, 2002.

4.Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", First Edition, PHI Learning Pvt. Ltd., 2

Computer usage: Nil

Professional component

General	-	0%
Basic Sciences	-	0%
Engineering sciences & Technical arts	-	0%
Professional subject	-	100%

Broad area : Signal Processing | Communication | Electronics | VLSI | Embedded

Test Schedule

S. No.	Test	Tentative Date	Portions	Duration
1	Cycle Test-1	August 1st week	Session 1 to 14	2 Periods
2	Cycle Test-2	September 2nd week	Session 15 to 27	2 Periods
3	Model Test	October 2nd week	Session 1 to 45	3 Hrs
4	University Examination	TBA	All sessions / Units	3 Hrs.

Mapping of Instructional Objectives with Program Outcome

The scope of this course is to provide the complete analysis of Digital Image Processing. This knowledge helps them to acquire better application of these principles in Digital Image Processing. The overall objective is to introduce the student to the basics of signal theory. This course emphasizes:	**Correlates to program outcome**		
	H	**M**	**L**
1. Review the fundamental concepts of a digital image processing system	a,h	f	-
2. Analyze images in the frequency domain using various transforms	c,g	a,b	i
3. Evaluate the techniques for image enhancement and image restoration	b,k	a,c,g,h,i	-
4. Categorize various compression techniques.	b,j	a,e,i,k	-
5. Interpret Image compression standards	-	b,e,f,g,k	i
6. Interpret image segmentation and representation techniques.	f	d,e,g	

H: high correlation, M: medium correlation, L: low correlation

Draft Lecture Schedule

S.NO	No.of Periods	Topics/ Sub-Topics	Problem Solving (Yes/No)	Reference (Book/Journal) Page No
UNIT I DIGITAL IMAGE FUNDAMENTAL				
1.	1	Elements of digital image processing systems	No	T1, R1
2.	1	Vidicon and Digital Camera working principles	No	
3.	1	Elements of visual perception	No	
4.	1	Brightness, contrast, hue	No	
5.	1	saturation, mach band effect	No	
6.	1	Color image fundamentals - RGB, HSI models	No	
7.	1	Image sampling and quantization	No	
8.	1	Two-dimensional mathematical preliminaries	No	
9.	1	Singular Value Decomposition and its properties	No	
UNIT II IMAGE TRANSFORMS				
10.	1	Introduction to Fourier Transform	No	T1, R1
11.	1	1D DFT and its properties	No	
12.	1	2D DFT and its properties	No	
13.	1	Discrete Cosine Transform and its properties	No	
14.	1	Sine, Hadamard Transform and its properties	No	
15.	1	Hear Transform and its properties	No	
16.	1	Slant Transform and its properties	No	
17.	1	Karhunen – Loeve transforms and its properties	No	
18.	1	SVD transform and their properties.	No	
UNIT III IMAGE ENHANCEMENT				
19.	1	Spatial Domain methods: Basic grey level transformation	No	T1, R1
20.	1	Histogram equalization Histogram specification techniques	No	
21.	1	Noise Distributions	No	
22.	1	Image subtraction and Image averaging	No	
23.	1	Smoothing, sharpening filters	No	
24.	2	Nonlinear filters , Homomorphic filtering	No	
25.	2	False color, Pseudo color and Color image enhancement techniques	No	
UNIT IV IMAGE RESTORATION AND RECOGNITION				

26.	2	Model of Image Degradation/restoration process	No	T1, R1
27.	1	Noise models	No	
28.	2	Unconstrained and Constrained restoration	No	
29.	1	Inverse filtering	No	
30.	1	Least mean square filtering	No	
31.	1	Pattern Classes, optimal statistical classifiers	No	
32.	1	Neural networks and associated training methods and use of neural networks in image processing	No	
UNIT V IMAGE COMPRESSION				
33.	1	Need for data compression, Different types of compression	No	T1, R1
34.	1	Run length coding-Huffman Coding	Yes	
35.	1	Shift codes, Arithmetic coding	Yes	
36.	1	bit plane coding	Yes	
37.	1	transform coding	Yes	
38.	1	Basics of Image compression standards: JPEG Standard	No	
39.	1	Wavelet transform, Predictive techniques	No	
40.	1	Block truncation coding schemes	No	
41.	1	Facet modeling	No	

Total No. of Periods: 60

Teaching Strategies

The teaching in this course aims at establishing a good fundamental understanding of the areas covered using:

- Formal face-to-face lectures
- Small periodic quizzes, to enable you to assess your understanding of the concepts.

Evaluation Strategies

Cycle Test – I	-	10%
Cycle Test – II	-	10%
Model Test	-	25%
Attendance	-	5%
Final exam	-	50%

Prepared by :B.Karthik, Assistant Professor, Department of ECE **Dated :**

Addendum

ABET Outcomes expected of graduates of B.Tech / ECE / program by the time that they graduate:

(a) an ability to apply knowledge of mathematics, science, and engineering

(b) an ability to design and conduct experiments, as well as to analyze and interpret data

(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

(d) an ability to function on multidisciplinary teams

(e) an ability to identify, formulate, and solve engineering problems

(f) an understanding of professional and ethical responsibility

(g) an ability to communicate effectively

(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

(i) a recognition of the need for, and an ability to engage in life-long learning

(j) a knowledge of contemporary issues

(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Program Educational Objectives

PEO1: PREPARATION:
To provide strong foundation in mathematical, scientific and engineering fundamentals necessary to analyze, formulate and solve engineering problems in the field of Electronics And Communication Engineering.

PEO2: CORE COMPETENCE:
To enhance the skills and experience in defining problems in Electronics And Communication Engineering design and implement, analyzing the experimental evaluations, and finally making appropriate decisions.

PEO3: PROFESSIONALISM:
To enhance their skills and embrace new Electronics And Communication Engineering Technologies through self-directed professional development and post-graduate training or education

PEO4: SKILL:
To provide training for developing soft skills such as proficiency in many languages, technical communication, verbal, logical, analytical, comprehension, team building, inter personal relationship, group discussion and leadership skill to become a better professional.

PEO5: ETHICS:
Apply the ethical and social aspects of modern communication technologies to the design, development, and usage of electronics engineering.

Course Teacher	Signature
Mr.B.Karthik	

Course Coordinator
(Mr.B.Karthik)

Academic Coordinator

Professor In-Charge

HOD/ECE
(Dr.M.Sundararajan)