Birla Institute of Technology and Science Pilani, Dubai Campus

IV Yr. B.E.(Hons.) First Semester Academic Year 2011 – 2012

COMPREHENSIVE EXAMINATION

IMAGE PROCESSING (ELECTIVE)

Course No.	: EA C443	Date	: 11-01-2012
Duration	:,3 Hours	Max Marks	: 40
Time	:12:30 PM to 03:30 PM	Weightage	: 40%

Note: *Answer all the questions, Missing data can be suitably assumed*

1 Explain how Homomorphic filtering can be used to separate the incident (illumination) component and the reflectance component of the image and then filter the low contrast image to get enhanced image. 4

2 Given a 4x4 image f(x,y) shown below compute the 2D Discrete Fourier Transform for following coordinates (1,2) , (2,2) , (3,2) (3,3) 8

4	8	3	2
1	0	2	1
4	5	3	2
1	3	3	2

3 Filter the following 3x3 image *f(x,y)* using optical transfer function *h(x,y)* shown below 5

f(x,y)=

3	12	2
3	34	0
2	20	1

h(x,y)=

1	1	1
1	-8	1
1	1	1

4 Explain the following Image enhancement technique 4

a) Histogram equalization

b) Gray Level Slicing

5 Given following 4x4 image which has 4 gray levels 0,1 2, 3 compress the image using Huffman coding technique and calculate the entropy , compression ratio and redundancy. 6

1	3	3	2
1	0	2	1
3	2	1	1
1	3	3	2

6 What is Radon Transform? Explain image reconstruction technique using projections. 4

7 Explain the following noise only spatial filtering techniques using an example 3x3 image given below 6

f(x,y) =

3	5	2
3	4	0
2	2	1

a) Geometric mean filter
b) Contraharmonic mean filter

8 Explain the following properties with respect to 2D Discrete Fourier Transform 3
a) Shifting property
b) Seperability property
c) Scaling property

BITS-Pilani Dubai Campus, Dubai International Academic City, Dubai

IV Yr. B.E.(Hons.) First Semester Academic Year 2011 – 2012

IMAGE PROCESSING (ELECTIVE) TEST II (OPEN BOOK)

Course No. : EA C443
Duration : 50 Mins

Date : 18-12-2011
Max Marks : 20
Weightage : 20%

Note: *Answer all the questions, Missing data can be suitably assumed , only prescribed text book and handwritten class notes are allowed.*

1 Compute the entropy of the following image f(x,y) which has only four gray levels **3**

0	1	0	0
0	1	2	2
0	1	2	3
1	2	2	3

2 For the image shown below which has only four gray levels , compute the degree of compression that can be achieved using **6**

3	3	3	2
2	3	3	3
3	2	2	2
2	1	1	0

a) Huffman coding of pixel values

b) Run length coding

(Assume 2 bits to represent the pixel values and 2 bits to represent the run length)

3 Given a degraded image f(x,y) , which is degraded by degradation function h(x,y), the degradation function H(u,v) is given by **3**

$$H(u,v) = \frac{T}{\pi(ua+ub)} \sin[\pi(ua+vb)]\, e^{-j\pi(ua+ub)}$$

Write a MATLAB program to read an image and degrade it using above degradation function and restore the image.

4 Consider the problem of image blurring caused by uniform acceleration in the y direction. If the image is rest at time t=0 and accelerates with a uniform acceleration $y_0(t)=at^2/4$ for a time T, find the blurring function H(u,v). You may assume that shutter opening and closing times are negligible. **3**

5 Given following 4x4 degraded image *g(x,y)* **5**

2	2	1	3
4	1	1	0
5	3	5	0
8	7	8	8

and degradation function *h(x,y)* is given below

0.1	0.5	0.1	0.5
0.5	0.1	0.5	0.1
0.1	0.5	0.1	0.5
0.5	0.1	0.5	0.1

Find the approximate restored image f(x,y) using inverse filter neglecting the external noise.

Given below the kernel of Discrete Fourier Transform

1	1	1	1
1	-j	-1	j
1	-1	1	-1
1	j	-1	-j

2D Fourier transform of function f is ***kernel x f x kernel***

2D inverse Fourier transform of function f is ***kernel* x f x kernel****

**********BEST OF LUCK**********

BITS-Pilani Dubai Campus, Dubai International Academic City, Dubai

IV Yr. B.E.(Hons.) First Semester Academic Year 2011 – 2012

IMAGE PROCESSING (ELECTIVE)

Course No. : EA C443
Duration : 50 Mins

Date : 23-10-2011
Max Marks : 25
Weightage : 25%

Note: Answer all the questions, Missing data can be assumed

Q1 Suppose that a flat area with center at (x_0,y_0) is illuminated by a light source with intensity distribution **05**

$$i(x,y) = Ke^{-[(x-x_0)^2+(y-y_0)^2]}$$

Assume for simplicity that the reflectance of the area is constant and equal to 1.0, and let K=255. If the resulting image is digitized with ***k*** bits of intensity resolution, and the eye can detect an abrupt change of eight shades of intensity between adjacent pixels, what value of ***k*** will cause visible false contouring.

Q2 Explain the following with an example **04**

i. Histogram equalization

ii. Gray level slicing

Q3 Give the expression for the 2D Fourier Transform and explain its properties? **05**

Obtain the 2D Discrete Fourier transform basis image for 4x4 image and 2D DFT, F(u,v) for an image f(x,y) given below, for following (u,v) values.

(2,2), (3,2), (3,3), (1,3)

f(x,y) =

24	34	30	41
23	12	10	8
10	12	23	34
23	24	23	18

Q4 What is Homomorphic image processing? Explain **04**

Q5 What is Hough transform? Explain **04**

Q6 Explain region splitting and merging method of obtaining the region of the image. **03**

********** WISH YOU GOOD LUCK **********

BITS PILANI, DUBAI CAMPUS

SECOND SEMESTER 2010- 2011

FOURTH **YEAR (QUIZ-II)**

Course Code: EA C443 Date: 05-12-2011

Course Title: IMAGE PROCESSING (ELECTIVE-V) Max Marks: 7

Duration: 20 minutes Weightage: 7%

Name: . . . . . **ID No:**

Important Note: Strictly write the Answers in the space provided.

1 The transform which is widely used to detect the lines in an image is 0.5

_____

2 Which one of the following is a lossy coding 0.5

A. Run length coding
B. Uniform quantizer
C. Huffman Coding
D. Predictive coding without quantizer

3 The operator which can be used to detect edges in the image is 0.5

A. Logarithm
B. Exponential
C. Gradient
D. Average

4 Basic principle of variable length coding is _____ 0.5

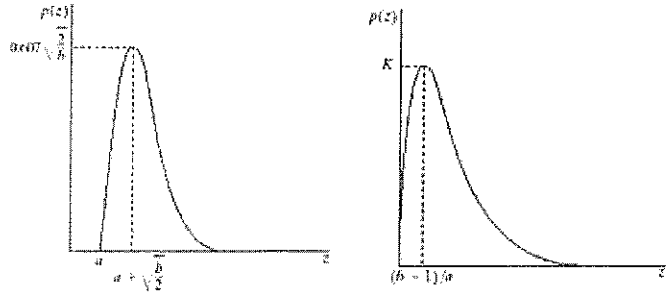
5 Given below is a 3x3 image. What will be the value of center pixel , when this image is passed through a 2

I. Geometric mean filter = _____

II. Harmonic mean filter = _____

1	7	5
6	2	3
1	4	2

6 Given following probability distribution function , identify for what type of noise model it belongs to 1.5



Ans : _____ , _____

7 What are three methods for estimating the degradation model 1.5

Ans_____

BITS PILANI, DUBAI CAMPUS

SECOND SEMESTER 2010- 2011

FOURTH **YEAR (QUIZ-I)**

Course Code: EA C443
Course Title: IMAGE PROCESSING (ELECTIVE-V)
Duration: 20 minutes

Date: 26-09-2011
Max Marks: 7
Weightage: 7%

Name: ..... **ID No:** ..... **Sec / Prog:** .....

SET A

Important Note: Strictly write the Answers in the space provided.

1 Given a 4x4 image perform the median filtering on the image

25	120	30	8
3	67	45	34
24	56	223	34
45	67	66	55

Ans: Fill only blank cells 2

0		30	
24		45	
24		56	
0	45	55	0

2. The third bit plane corresponding to the image $\begin{bmatrix} 4 & 3 \\ 5 & 2 \end{bmatrix}$ is $\begin{bmatrix} & \\ & \end{bmatrix}$ 1

3 Filter the image $f(x,y) = \begin{bmatrix} 4 & 9 & 9 \\ 8 & 2 & 3 \\ 5 & 6 & 8 \end{bmatrix}$ with $h(x,y) = \begin{bmatrix} -1 & -1 & -1 \\ -1 & 8 & -1 \\ -1 & -1 & -1 \end{bmatrix}$

Ans: Fill only blank cells 2

13		58
38	-36	
		53

4 What will be the time required to send 256x256 color RGB image through a voice graded telephone line , which can transmit 9000 bits/sec of data. 1

5 An image can be modeled as _____ function 1

6 Draw the transformation curve for the conversion of grayscale image to the binary image. 1