21/11/13

Roll No. | | | | | | | | | | |

B.E / B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, NOV / DEC 2013

Common to ELECTRONICS AND COMMUNICATION ENGINEERING and
BIO MEDICAL ENGINEERING BRANCH

Seventh Semester

EC 9036 – DIGITAL IMAGE PROCESSING

(Regulation 2008)

Time: 3 Hours   Answer ALL Questions   Max. Marks 100

PART-A (10 x 2 = 20 Marks)

1. List out the different image file formats.
2. Convert the RGB into CMY model and HSI model.
3. Perform the grey level slicing on the following 3 bit image. Consider the threshold levels of 3 and 6.

3	4	5
6	6	7
1	2	2

4. Write the probability density function of noise model that can be effectively removed by order statistic filter.
5. Write the spatial transformation equations to eliminate the geometric distortion which is modeled by bilinear equations.
6. Draw the image degradation model and write the power spectrum for the output of this model.
7. Compute the magnitude and direction of the gradient of an image for the marked pixel

1	2	3
2	[4]	5
3	4	3

8. Write the conditions to be followed to perform region based segmentation.
9. Calculate the compression ratio of the 8 bit RGB image of size 1024 x 1024 which when compressed occupies 4 MB.
10. Derive the bit rate and memory requirement to store each frame that results from digitization of 625 line system, assume source intermediate format.

PART-B (5 x 16 = 80 Marks)

11. (i). A certain X – ray imaging geometry produces a blurring degradation that can be

modeled as the convolution of the sensed image with the spatial circularly symmetric function $h(r) = [(r^2 - \sigma^2)/\sigma^4]\, e^{-r^2/2\sigma^2}$ where $r^2 = x^2 + y^2$. Show that the degradation in frequency domain is given by the expression

$$H(u,v) = -\sqrt{2\pi}\,\sigma\,(u^2 + v^2)/e^{-2\pi^2\sigma^2(u^2+v^2)}$$ (8)

(ii). Derive Wiener filter for image restoration, also mention the condition in which the behavior of Wiener filter resembles the inverse filter. (8)

12. a. (i). Determine the reconstructed image when the image $f(x,y) = 2\cos 2\pi(3x + 4y)$ is sampled at $\Delta x = \Delta y = 0.2$. Assume ideal low pass filter with bandwidth (2.5, 2.5). (8)

(ii). Using DCT prove the energy compaction property for the given image (4)

1	1	1	1
1	1	1	1
1	1	1	1
1	1	1	1

(iii). State and prove the property to obtain the centering of 2D DFT (4)

(or)

b. Find the KL transform of the image and verify.

4	-2
-1	3

13. a. (i). Perform Histogram equalization for the given image. Draw the Histogram of the image before and after equalization. (8)

1	6	2	4
3	1	2	2
4	2	3	5
2	3	1	2

(ii). Explain how smoothing and sharpening operations are performed on an image using spatial filters. (8)

(or)

b. (i). Perform Geometric mean, harmonic mean and Alpha – trimmed mean filter (Assume d= 2), for the given image (for the marked pixel only) (8)

[30]	10	20
10	250	25
20	[25]	30

(ii). Explain how illumination and reflectance components of an image can be enhanced independently. (8)

14. a. (i). Explain global edge linking method used in line detection. (8)

(ii). Compare the performance of first and second order derivative in the detection of point, line and edge. (8)

(or)

b. Explain watershed algorithm using dam construction. And mention how to overcome the problem of over segmentation.

15. a. (i). Describe vector quantization algorithm with suitable example. (8)

(ii). Compute the degree of compression that can be achieved using Huffman coding and Run length coding for the given image. (8)

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

(or)

b. (i). Describe various steps involved in encoding an image using JPEG standard. (8)

(ii). For the given probability model ($a_1 - 0.2$, $a_2 - 0.3$, $a_3 - 0.5$), determine the real valued tag using arithmetic coding for the sequence $a_1a_1a_3a_2a_3a_1$. (8)