B.E DEGREE END SEMESTER EXAMINATIONS, NOV/DEC 2012
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
EC 9036 DIGITAL IMAGE PROCESSING
VII – SEMESTER ECE & BME

Time: 3 Hours **Max.marks: 100**

Answer ALL questions

PART-A **(10X2=20 marks)**

1. Justify that perceived brightness is not a simple function of intensity.
2. Prove the decorrelation property of KL transform.
3. Determine the Laplacian of the 1 X 3 center region of image f(x,y) = [1 2 3 1 2; 1 2 1 2 1; 1 2 3 3 4].
4. How directional smoothing filter is better than moving average filter.
5. What are tie points?
6. Draw the block diagram of imade degradation model.
7. What is adaptive thresholding.
8. How first and second order derivatives respond to step and ramp edges.
9. Define any two objective measures of image fidelity.
10. What is the memory required to store half an hour video that result from digitization of 525 line system assuming source intermediate format.

PART-B **(5X16=80 marks)**

11.i) An image is at rest at time t =0 and accelerates with a uniform acceleration $x_0(t) = at^2/2$ in x direction for a time T. Determine the transfer function H(u,v).

ii) The input to a linear position invariant image degradation system with impulse response $h(x-\alpha, y-\beta) = \exp[-((x-\alpha)^2 + (y-\beta)^2)]$ is given by $f(x,y) = \delta(x-a)$. Determine the degraded image g(x,y) assuming no noise.

12.a i) An image $f(x,y) = 2\cos[2\pi(4x + 6y)]$ is sampled on an infinite grid of points with sampling intervals $\Delta x = 0.1$, $\Delta y = 0.2$ in the x and y directions respectively. Using appropriate equations, derive the reconstructed image. (12)

ii) Explain how HSI model is obtained from RGB model. (4)

OR

b.i) Determine the singular value decomposition of the image [0 1 1 ; 1 0 -1 ; 1 -1 0]. (12)

ii) Prove energy compaction property of DCT for the given image [2 2 ; 2 2]; (4)

13.a.(i) Generate the 3 X 3 mask that averages the 4-neighbors of a point (x,y) but excludes the point itself and determine the filtered image for the input image given by [1 4 1 ; 4 1 2 ; 1 1 5].

(ii) Determine the histogram equalization of an image given below.

$$\begin{pmatrix} 1 & 3 & 2 & 4 \\ 2 & 4 & 1 & 1 \\ 1 & 3 & 1 & 1 \\ 1 & 2 & 1 & 1 \end{pmatrix}$$

OR

13b.(i) With neat block diagram, explain homomorphic filtering. (6)

(ii) Determine the filtered output of the image [1 4 1 ; 4 1 2 ; 1 1 5] using mean, geometric mean, harmonic mean and contraharmonic mean filters. Assume zero padding along the edges. (10)

14.a.(i) Explain the edge linking algorithm for obtaining normal representation of a line from its slope-intercept equation y = ax+ b.

(ii)Determine the edge detected output of input image f(x,y) = [0 0 0 0 0 ; 0 128 8 64 0 ; 0 32 8 8 0 ; 0 64 128 64 0 ; 0 16 128 64 0] using prewitt and sobel operators.

OR

14.b.(i) Explain in detail how watershed algorithm is employed for image segmentation.

(ii) Describe split and merge technique. Using this algorithm, determine the final Output for the given input image f(x,y) = [4 4 4 4 4 ; 4 1 1 1 10 ; 4 1 1 1 10 ; 4 10 10 10 10 ; 4 10 10 10 10] .

15.a (i) For the given input image, determine the compression ratio that can be achieved using Huffman coding. F(x, y) = [2 1 3 1 ; 0 1 2 2 ; 3 1 2 1 ; 1 1 2 3].

(ii) Explain how vector quantization is applied in image compression.

OR

15b (i) Explain how entropy encoding of JPEG encoder is used to encode the DCT of an image block.

(ii) A source generates sequence aacbca, find the encoding tag using arithmetic coding. Also, decode and recover the sequence from the tag. The probabilitites for the symbols are p(a) = 0.2, p(b) = 0.3, p(c) = 0.5 .