Digital Image Processing (ELL715)
Max Marks: 30

IInd semester 2015-16
Max Duration: 2 hours

Q1. Construct the distance vs angle signatures for the following boundaries:
(i) A rectangle with length a and width b.
(ii) A regular hexagon with length of side a. **(2+2)**

Q2. (i) Find the Fourier descriptors for the following boundaries:
(a) A square with length of side = 1.
(b) An equilateral triangle with length of side = 1.
(ii) In each case, reconstruct the original boundaries using only the first two descriptor coefficients. **(2+2+2)**

Q3. Given the following image

$$\begin{bmatrix} 1 & 2 & 1 & 1 & 2 & 1 \\ 2 & 3 & 1 & 2 & 3 & 1 \\ 1 & 1 & 2 & 2 & 3 & 1 \\ 2 & 1 & 3 & 1 & 1 & 2 \\ 1 & 2 & 2 & 2 & 2 & 1 \\ 3 & 3 & 2 & 2 & 1 & 1 \end{bmatrix}$$

(i) Construct the co-occurrence matrix using the position operator Q as "one to the right".
(ii) Compute (a) Contrast, (b) Uniformity, and comment of the result. **(2+2)**

Q4. Given the following four vectors, perform PCA:

$$[0,0,0]^T; [1,0,1]^T; [1,1,1]^T; [0,1,0]^T$$

(i) What is the covariance matrix?
(ii) What are the eigen values?
(iii) What are the eigen vectors?
(iv) What are the transformed points?
(v) Plot the transformed points in the new space. (2+1+2+2+1)

Q5. Given the following four points in a two dimensional space:

$$[0,0]^T; [0,1]^T; [1,1]^T; [1,0]^T$$

Assume that the first three points belong to class 1 and the last belongs to class 2.
(i) (a) Construct a minimum distance classifier and obtain the decision boundary.
(b) Clearly specify all the intermediate steps and values.
(ii) (a) Construct a Bayes classifier (assuming each class samples are from a Gaussian distribution) and obtain the decision boundary.
(b) Clearly specify all the intermediate steps and values. (2+1+3+2)