

GUJARAT TECHNOLOGICAL UNIVERSITY**M. E. - SEMESTER – IV • EXAMINATION – SUMMER • 2014****Subject code: 744101****Date: 04-06-2014****Subject Name: Advanced Topics in Signal and Image Processing****Time: 02:30 pm - 05:00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

Q.1 (a) Explain the Bartlett method for power spectrum estimation in detail. **07**

(b) Explain the different criteria for selecting the AR model order. **07**

Q.2 (a) Explain the covariance method for AR model parameter estimation with suitable equations. **07**

(b) Determine the mean and the autocorrelation of the sequence $x(n)$ generated by the MA(2) process described by the difference equation **07**

$$x(n) = w(n) - 2w(n-1) + w(n-2)$$

Where $w(n)$ is a white noise process with variance σ_w^2

OR

(b) Explain the properties of continuous wavelet transform (CWT). **07**

Q.3 (a) What are basis functions? Write down bases for spaces V_1 , V_{-1} and W_{-1} of Haar MRA. **07**

(b) Consider the function $f(t) = \begin{cases} 1 - |t|, & -1 \leq t \leq 1 \\ 0, & \text{otherwise} \end{cases}$. Obtain the projection of $f(t)$ on V_0 and W_0 subspaces of Haar MRA. Sketch original function and projections you obtained. **07**

OR

Q.3 (a) Write PCA algorithm and briefly explain all the steps with suitable equations. **07**

(b) Explain the use of kurtosis for separating independent components. State the advantages and disadvantages of kurtosis measure. **07**

Q.4 (a) Compute the hierarchical clustering using the complete linkage algorithm for the given data **07**

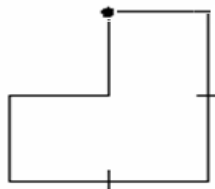
	X	Y
1	4	4
2	8	4
3	15	8
4	24	4
5	24	12

(b) Consider the shape as shown in the following figure. **07**

1. What is the order of the shape number.

2. Obtain the shape number

Assume 4-directional chain code.



OR

- Q.4 (a)** Write an iterative algorithm for computing medial axis transform. Draw the medial axis of a circle, a rectangle and a square. **07**
- (b)** List out the properties of Fourier Descriptors. **07**
- Q.5 (a)** List the steps for designing a statistical visual pattern classifier. **07**
- (b)** An image retrieval system produced the following 10 ranked results for a search operation against a database of 500 images, of which 5 are relevant to the query: **07**

Rank	1	2	3	4	5	6	7	8	9	10
Result	R	R	N	R	N	N	N	R	N	R

Where *R* means *relevant* and *N* means *not relevant*. Compute the precision and recall for the given retrieval results.

OR

- Q.5 (a)** How would a sample with a feature vector (1,1) be classified if samples from class A are at (3,0),(4,1) and (3,2) and samples from class B are at (1,-1) and (1,-1.5) using the Euclidean distance and the single nearest neighbor rule. **07**
- (b)** Explain the k-Nearest Neighbor classifier in detail. Also list out the advantages and disadvantages of k-NN classifier. **07**
