# GUJARAT TECHNOLOGICAL UNIVERSITY M. E. - SEMESTER – IV- EXAMINATION – SUMMER • 2014

# Subject code: 744101Date: 04-06-2014Subject Name: Advanced Topics in Signal and Image Processing<br/>Time: 02:30 pm - 05:00 pmTotal Marks: 70Instructions:Total Marks: 70

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

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

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

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

## 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 07 advantages and disadvantages of kurtosis measure.
- Q.4 (a) Compute the hierarchical clustering using the complete linkage algorithm for the 07 given data



- (b) Consider the shape as shown in the following figure.
  - 1. What is the order of the shape number.
    - 2. Obtain the shape number

Assume 4-directional chain code.



- Q.4 (a) Write an iterative algorithm for computing medial axis transform. Draw the medial axis of a circle, a rectangle and a square.
  (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 <u>a database of 500 images</u>, of which 5 are relevant to the query:

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 07 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.
  - (b) Explain the k-Nearest Neighbor classifier in detail. Also list out the advantages and disadvantages of k-NN classifier.

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