

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY
ME Semester –III Examination Dec. - 2011

Subject code: 730405

Date: 08/12/2011

Subject Name: Adaptive Signal Processing

Time: 10.30 am – 01.00 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 four basic classes of adaptive filtering applications. **07**
(b) Define correlation matrix and prove any two properties of correlation matrix **07**

- Q.2** (a) State and derive the principal of orthogonality. **07**
(b) Explain the Yule-Walker equation for a WSS process **07**
- OR**
- (b) Define power spectral density and derive any two properties **07**

- Q.3** (a) Derive Winner-hopf equation for a filtering problem **07**
(b) Derive mean square error in canonical form for Winner filter **07**

OR

- Q.3** (a) Consider a Wiener filtering problem characterized by the following values for the correlation matrix R of the tap-input vector $u(n)$ & the cross correlation vector P between $u(n)$ and the desired response $d(n)$ **07**

$$R = \begin{pmatrix} 1 & 0.5 \\ 0.5 & 1 \end{pmatrix}$$

$$P = \begin{pmatrix} 0.5 \\ 0.25 \end{pmatrix}$$

- (a) Suggest a suitable value for the step size parameter μ that would ensure convergence of the method of Steepest descent, based on the given value for matrix R.
- (b) If mean square error is given by, $J = 15 + 20W + 10W^2$ then find out, **07**
a) W_{opt} and J_{min}
b) Given Steepest descent algorithm for conversion factor $\mu = 0.04$, determine J_{min} after 3 iteration.

- Q.4** (a) Show the Misadjustment parameter for LMS filter is $M = (\mu / 2) * \text{tr}[R]$ **07**
(b) Explain the all-pole, all-pass lattice structure for linear predictors. **07**

OR

- Q.4** (a) Explain forward liner prediction **07**

- Q.4 (b)** Apply steepest –descent algorithm to winner filter and derive weight update equation. **07**
- Q.5 (a)** Compare the LMS algorithm with the Steepest descent algorithm **07**
(b) Derive mean square error in canonical form for LMS algorithm **07**
- OR**
- Q.5 (a)** Explain and Derive LMS algorithm **07**
(b) Explain RLS algorithm **07**
