Subject Code: H4501/R13

M. Tech –II Semester Regular/ Supply Examinations, October, 2015

ADAPTIVE SIGNAL PROCESSING

(Common to SSP, DIP, CE&SP, IP, C&SP, SP&C)

Time: 3 Hours **Max Marks: 60**

Answer any FIVE questions

All questions carry EQUAL marks

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1 a Draw the block diagram of a generic adaptive filter and briefly state its aim. (6M)

b Explain the nonlinear adaptive filtering with multiplier perceptrons (6M)

2 Given the tap delay line vector and coefficient vector of an adaptive filter of length L,

$$\underline{x}_n = \begin{bmatrix} x[n] \\ x[n-1] \\ \vdots \\ x[n-L+1] \end{bmatrix} \qquad \underline{w} = \begin{bmatrix} w_0^* \\ w_1^* \\ \vdots \\ w_{L-1}^* \end{bmatrix}$$

derive the Wiener-Hopf equation from the principle of orthogonality, $E\{\underline{x}_n e^*[n]\} = \underline{0}$, where $e[n]$ is the error signal. (12M)

3 a Discuss the similarities and differences between the method of steepest descentand a stochastic gradient approach. (6M)

b Explain Gradient Search by Newton's Method (6M)

4 a Derive a practical step size bound for the LMS algorithm from equation $\underline{v}_{n+1} = (\underline{\underline{I}} - \mu\underline{\underline{\Lambda}})\underline{v}_n$ (6M)

whereby $\underline{v}_n = \underline{\underline{Q}}(E\{\underline{w}_n\} - \underline{w}_{opt})$ with the eigenvalue decomposition

$$\underline{\underline{R}} = \underline{\underline{Q}} \cdot \underline{\underline{\Lambda}} \cdot \underline{\underline{Q}}^H$$

b Explain the Stability and Performance analysis of LMS Algorithms. (6M)

5 a Explain the procedural steps for Kalman Filter (6M)

b Define Innovation Process and Kalman Gain (6M)

6 a Explain the Principle of Orthogonality? Give the mathematical representation (6M)

b What are the two aspects of the performance of an adaptive filter ?Explain (6M)

7 a Explain the RLS Algorithm (6M)

b Explain the Adaptive Linear Combiner (6M)

8 Write short notes on the following (12M)