Hall Ticket Number:

Code No.: 5135 M

VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

M.E. (CBCS : ECE) I-Semester Make up Examinations, March-2017

(Communication Engineering & Signal Processing)

Adaptive Signal Processing

Time: 3 hours Max. Marks: 70

Note: Answer ALL questions in Part-A and any FIVE from Part-B

Part-A (10 × 2 = 20 Marks)

1. Explain the principle of adaption.
2. Discuss the need for Adaptive filtering.
3. What is convergence of LMS algorithm?
4. Define LMS gradient algorithm.
5. State the importance of Adaptive noise cancellers.
6. State the application of echo cancellation.
7. Write the statement of Kalman filtering problem.
8. Give examples of Adaptive filtering.
9. Briefly discuss the application of Kalman filter.
10. Write the difference between scalar Kalman filter and Vector Kalman filter.

Part-B (5 × 10 = 50 Marks)

11. a) Give the block diagram of an Adaptive system and explain the principle of adaption in detail. Hence explain the application of the Adaptive system for real time analysis. [5]

    b) Let $y(n) = w_o x(n)+w_1 x(n-1)+w_2 x(n-2)$ and $x(n)$ is a stationary signal. If $R_{xx}(0) = 1$, $R_{xx}(1) = 0.250$, $R_{xx}(2) = 0.350$, $R_{xy}(0) = 0.150$, $R_{xy}(1) = 0.25$ and $R_{xy}(2) = 0.50$ [5]

    i) Find the weights of the filter.

    ii) What is minimum mean squared error produced by the filter?

12. a) Consider a Wiener filter problem, characterized by the following values for the correlation matrix R of the tap input vector v(n) and the cross correlation vector between v(n) and desired response $R = \begin{bmatrix} 1 & 0.5 \\ 0.5 & 1 \end{bmatrix}$ $P = \begin{bmatrix} 0.5 \\ 0.25 \end{bmatrix}$ [6]

    i) 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.

    ii) Compute the elements $w_1(n)$, $w_2(n)$ of the tap weight vector w(n).

    b) Derive canonical form of error performance surface and write properties of Adaptive filters. [4]

13. a) Draw the structure of Adaptive echo canceller. Discuss the significance of each signal. [5]

    b) Classify and discuss various beam forming techniques used in Adaptive beam forming applications. [5]

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14. a) Compare Wiener filter with direct filter design and discuss the merits of Kalman filter over Wiener filter with the help of a neat block diagram. [6]

    b) What is innovation? List and derive the properties of innovation in Kalman filter design. [4]

15. a) Discuss how tracking is done using Kalman filter in Radar applications. [5]

    b) Derive the equations for Signal vectors and Data vectors used in Vector Kalman filtering and specify the need for Vector Kalman filters. [5]

16. a) Draw the diagram of linear discrete transversal filter and write the equations for its operation using LMS algorithm. [5]

    b) Derive the least mean square error for Wiener filters. [5]

17. Answer any ***two*** of the following:

    a) Recursive least square estimation [5]

    b) Target tracking [5]

    c) Mean Square Estimation of Kalman filtering. [5]