Total number of printed pages – 4 **B. Tech**

PEEC 5402

Eighth Semester Examination – 2008

ADAPTIVE SIGNAL PROCESSING

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*

The figures in the right-hand margin indicate marks.

All the acronyms carry their usual meaning. Make suitable assumptions wherever necessary. Draw neat diagrams with proper labels.

1. Answer the following in brief. Provide suitable illustrations wherever necessary : 2 ×10

   (a) Which model is used for human vocal tract in LPC coding ? What is linear in LPC ?

   (b) What is adaptive in an adaptive filter ? How is it done ?

   (c) Prove the time shifting property of the z-transform.

   (d) What is enhanced in ALE ? What is the filter type ?

   (e) What is a most commonly used model for a communication channel ? Give its impulse response.

   (f) What type of filter best describes the LMS algorithm ? Give its schematic representation.

   (g) Plot the autocorrelation function of a white noise sequence.

   (h) What are the advantages of RLS algorithm over the LMS algorithm ?

   (i) Give the schematic representation of an AR system of order p.

   (j) Give the transfer function of a general MA system.

2. (a) Discuss any two properties of the LMS algorithm by deriving appropriate expressions. Draw suitable diagrams and state what are the assumptions. 8

(b) Can you establish the advantages / disadvantages of the LMS algorithm by making use of the answer as in part 2a. 2

3. (a) Explain adaptive noise cancellation by means of an adaptive filter. 5

(b) Derive the optimum filter you are familiar with. State the assumptions clearly. 5

4. Compare the LMS and the RLS algorithm. 10

5. (a) What is the objective of the square wave testing of an amplifier ? What information it provides ? 6

(b) Explain any method of frequency measurement. 4

6. Find the transfer function of the filter described by a difference equation of the type $y(n)=\frac{1}{3}[x(n-1)+x(n)+x(n+1)]$. Give a block schematic of this filter. What is the filter's response to $\delta(n)-\frac{1}{4}\delta(n-1)$? 5+1+4

7. (a) An autoregressive process is described by the difference equation

$x(n)-1.26x(n-1)-0.81x(n-2)+w(n)$. Compute the variance of x(n) if it is given that $r_{xx}(n)=E[x(n)x(n+1)]$ and the variance of w(n) is σ_w^2. 5

(b) Find the transfer function of this system if w(n) is the excitation function and x(n) is its response. 5

8. (a) Determine the response of the system given by $y(n)=2.5y(n-1)-y(n-2)+x(n)-5x(n-1)+6x(n-1)$ to an input signal given by $\delta(n)$. Show the locations of the zeros and the poles. 6

(b) What type of algorithm you would prefer to use in order to take care of time varying input signals from the MMSE point of view ? Justify. 4

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