Registration No : | | | | | | | | | | |

Total Number of Pages : 02 **M.Tech.**
P2AECC09

2nd Semester Regular Examination 2017-18
ADAPTIVE SIGNAL PROCESSING
BRANCH : APPLIED ELECTRO & INSTRUMENTATION ENGG, ELECTRO & INSTRUMENTATION ENGG, VLSI & EMBEDDED SYSTEMS, VLSI & EMBEDDED SYSTEMS DESIGN, VLSI DESIGN & EMBEDDED SYSTEMS
Time : 3 Hours
Max Marks : 100
Q.CODE : C954
Answer Question No.1 which is compulsory and any FOUR from the rest..
The figures in the right hand margin indicate marks.
Answer all parts of a question at a place.

Q1 **Answer the following questions:** **(2 x 10)**

a) Name two different block structures in which adaptive filters are typically used together with one important thing to consider when using each of them.

b) What is the difference between Kalman filter and Weiner filter?

c) Write the characteristics equation for R in terms of polynomial if

R = $\begin{bmatrix} p & q \\ r & s \end{bmatrix}$

d) What are the basic conditions that must fulfill for linear optimal filtering?

e) The estimated gradient in LMS algorithm is unbiased one? What do you predict from the estimation?

f) What are the parameters that are required for adaptive system identification?

g) What are the advantages of RLS algorithm over the LMS algorithm?

h) What is perturbation? What is its physical significance?

i) What are the constraints in designing Weiner filter?

j) What are the performance measures of the adaptive linear combiner?

Q2 **a)** Draw a single input adaptive linear combiner with single weight. Derive an expression for performance function. **(10)**

b) Establish the stability condition of the gradient search algorithm. **(10)**

Q3 **a)** Discuss any two properties of the LMS algorithm by deriving appropriate expressions. Draw suitable diagrams and state the assumptions that you used. **(10)**

b) Establish the advantages /disadvantages of the LMS algorithm that you have derived. **(10)**

Q4 **a)** Assuming that the output of the unknown system $C(z) = 1 + 0.5z^{-1}$ is not corrupted by noise, state the optimum zero-forcing (ZF) and minimum mean square error (MMSE) solutions for system identification. **(10)**

b) Derive an expression for gradient of mean square error performance surface. **(10)**

Q5 **a)** How Scalar Random Variables are estimated using recursive least square estimation method? **(10)**

b) Explain the initial conditions and assumptions taken in designing Kalman filter. **(10)**

Q6 **a)** Show that estimated gradient of weight vector is unbiased. **(10)**

b) Adaptive signals are non linear. Justify. **(10)**

Q7 **a)** For the input signal $x[n] = \cos(\pi \cdot n)$, derive the autocorrelation sequence of $x[n]$ the cross-correlation with $d[n] = -\cos(\pi \cdot n)$, and justify whether or not the Wiener-Hopf solution exists. If the Wiener-Hopf solution exists, calculate it. **(10)**

b) **Write short answer on :** **(10)**

i. ARMA model

ii. Adaptive prediction filter