Registration no: | | | | | | | | | | |

Total Number of Pages: 02 **B.Tech**
PEEL5401

7th Semester Back Examination 2019-20
ADAPTIVE SIGNAL PROCESSING
BRANCH: AEIE, BIOMED, ECE, EEE, EIE, ELECTRICAL, ETC, IEE
Max Marks: 70
Time: 3 Hours
Q.CODE:HB201

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

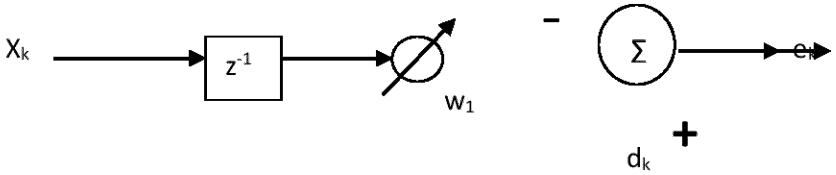
Q1 Answer the following questions: **(2 x 10)**
Suggested Words: How, Why, Determine, Derive, State, Write, Create, etc

a) State the advantages of closed loop systems over open loop systems.
b) Draw the block diagrams and the expressions for the output in the two types of adaptive linear combiner.
c) Define gradient for a performance function, and give the mathematical expression for it.
d) Define geometric ratio in refrence to checking stability of a gradient search process.
e) What is the significance of Wiener solution for any adaptive algorithm?
f) State and define any two performance parameters to compare between any two gradient search algorithms.
g) State the condition on the convergence parameter for a stable(convergent) learning curve.
h) What is the significance of finding the variance of a gradient estimate?
i) Write two limitations of Least Mean Square algorithm.
j) What is the limitation of steepest descent algorithm and what is the reason behind it?

Answer any five out of seven questions
Analyze, Justify, Design, Formulate, Calculate, Develop, Illustrate, Explain, Distinguish, Differences & Similarities

Q2 a) In context of an error performance surface, emphasise the geometrical significance of eigen value and eigen vector with the help of suitable plot. **(5)**
b) Prove that the error signal is decorrelated with the input signal in a linear adaptive filter, when the mean square error is minimum i.e. the filter is optimum. **(5)**

Q3 a) In the given below adaptive linear combiner involving a single weight, derive the expression for the performance function ξ (Mean Square Error). Also find the optimum filter weight. **(5)**



b) For the univariable performance surface given by $\varepsilon = 0.4w^2 + 4w + 11$, what range of values of the convergence parameter will provide a stable weight-adjustment curve. **(5)**

Q4 a) Justify the need for channel equalisation? Explain adaptive channel equalisation with suitable block diagram and supporting analytical expressions. **(5)**

b) What is weight deviation vector? Establish a relationship between mean square error ξ, minimum mean square error ξ_{min} and weight deviation vector. **(5)**

Q5 a) Define perturbation *P*. State and show the effect on the perturbation *P*, if a weight is added to a given traversal filter in general. **(5)**

b) What is the significance of characteristic equation for some matrix *R*. Write the characteristic equation for *R* in terms of a polynomial, if : **(5)**

$$R = \begin{bmatrix} a & b & c \\ b & a & b \\ c & b & a \end{bmatrix}$$

Discuss, Describe, Examine, Classify, Prove, Evaluate, Compare, Contrast, etc

Q6 Describe the problem of inverse modeling with a labeled block diagram. Derive an expression for the error e_k , in terms of the input signal s_k, for inverse modeling a system given by $H(z) = 4 - 3z^{-1}$. **(10)**

Q7 Explain the gradient search by Newton's method with neat diagram. Derive a weight-adjustment formula to apply Newtons's method to a performance surface. **(10)**

Q8 Write short answer on any Two: **(2 x 5)**

a) Adaptive Line Enhancer

b) Steepest Descent algorithm

c) XLMS algorithm