

GUJARAT TECHNOLOGICAL UNIVERSITY
ME - SEMESTER-1 (NEW) EXAMINATION – WINTER 2018

Subject Code: 3710501**Date: 07/01/2019****Subject Name: Advanced Digital Signal Processing****Time: 02:30 PM To 05:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full mark.

- Q.1** (a) List design techniques for FIR filter. Explain any two in detail. **07**
 (b) Write a short note on applications of DSP and multi-rate DSP. **07**
- Q.2** (a) Explain whitening and innovations representation of random processes and discuss special types of random processes: AR, MA, and ARMA. Also, discuss Yule-walker equations. **07**
 (b) The power density spectrum of an AR process $\{x(n)\}$ is given as **07**
 $[25/\{|1-e^{jw}+(1/2)e^{-j2w}|^2\}]$.
 (i) Determine the difference equation for generating the AR process when the excitation is white noise.
 (ii) Determine the system function for the whitening filter.
- OR**
- (b) Determine the lattice coefficients corresponding to the FIR filter with system **07**
 function $H(z) = A_3(z) = 1 + (13/24)z^{-1} + (5/8)z^{-2} + (1/3)z^{-3}$
- Q.3** (a) Explain linear prediction. Derive the normal equation for forward linear **07**
 predictor.
 (b) Show that the eigenvectors of any single-input adaptive linear combiner with two **07**
 weights are given by $Q=1/(\sqrt{2}) \begin{bmatrix} 1 & 1 \\ -1 & 1 \end{bmatrix}$.
- OR**
- Q.3** (a) Compare and discuss decimators and interpolators. **07**
 (b) Compare Newton's method with the steepest descent algorithm. Prove that step **07**
 size μ is dimensionless in Newton's method and has dimensions of reciprocal
 signal power in the steepest descent algorithm.
- Q.4** (a) Discuss designing of IIR filters from analog filters by approximations of **07**
 derivatives with an example.
 (b) Explain the LMS algorithm with a suitable example. **07**
- OR**
- Q.4** (a) Discuss designing of IIR filters using bilinear transformation with an example. **07**
 (b) Discuss any two applications of adaptive filters in detail. **07**
- Q.5** (a) Explain adaptive linear combiner with its mathematical analysis. **07**
 (b) Write a short note on digital filter banks for Multirate signal processing. **07**
- OR**
- Q.5** (a) Discuss properties of quadratic performance surface. **07**
 (b) What is subband coding? Discuss importance of multi-rate processing in **07**
 subband coding application.
