

(3 Hours)

[Total Marks: 80]

- N.B.: 1. Question one is Compulsory.
 2. Answer any three questions from the remaining five.
 3. Assume suitable data if required.

Q.1	All Questions are Compulsory	20M
a	Explain the concept of multi-resolution analysis using wavelet transform.	5M
b	Explain orthogonality principle in linear mean-square estimation.	5M
c	Describe with suitable diagram for forward linear prediction.	5M
d	Explain sampling rate conversion by non-integer factor.	5M
Q.2		20 M
a	Determine the frequency resolution of Bartlett, Welch, and Blackman-Tukey methods of power spectrum estimates for a quality factor $Q=10$. Assume that overlap in Welch method is 50% and length of sample sequence is 1000.	10M
b	Explain the relationship between the parameters of AR, MA and ARMA models of Power spectrum estimation and autocorrelation matrix of input data.	10M
Q.3		20 M
a	Explain FIR wiener filter and derive the expression for MSE and minimum MSE achieved by the wiener filter.	10M
b	With a neat diagram, explain AR lattice structure for an all-pole system.	10M
Q. 4		20 M
a	Explain Least mean square (LMS) adaptive algorithm and discuss its properties.	10M
b	Describe with suitable block diagram system identification and adaptive noise cancellation.	10M
Q.5		20 M
a	Design a two-stage decimator for the following specifications: $D = 100$ Passband: $0 \leq F \leq 50$ Transition band: $50 \leq F \leq 55$ Input sampling rate: 10,000 Hz Ripple: $\delta_1 = 10^{-1}$, $\delta_2 = 10^{-3}$	10M
b	Explain elimination of aliasing and polyphase form of the two-channel quadrature mirror filter (QMF) bank.	10M
Q.6		20 M
a	Describe how wavelet transform can be used for signal denoising. Also, discuss hard thresholding and soft thresholding for wavelet based denoising.	10M
b	Explain spectrum estimation using Bartlett Method. Compare the performance of Bartlett with Welch methods on the basis of Quality factor, Variance, Frequency resolution.	10M