Time:- 3Hrs.   **Maximum Marks: - 80**

N. B.
1. Q.1 is compulsory.
2. Answer any three out of the remaining five questions.
3. Figures to the right indicate marks.
4. Answer to the questions should be grouped and written together.

Q1.	Solve **any four** out of five	
a.	Periodogram is a consistent estimator. State True or False. Justify your answer.	**5**
b.	State the axioms of MRA.	**5**
c.	Explain with block diagram open and closed loop adaptive system	**5**
d.	Compare LMS and RLS algorithms	**5**
e.	The second-order AR process u(n) is described by the difference equation	**5**

$$u(n) = -0.5u(n-1) + u(n-2) + v(n)$$

where v(n) is a zero mean unit variance white process. Obtain the correlation matrix.

Q2 a. Determine and compare the computational complexity of a 2stage decimator with that of **10**
a single stage decimator that down samples an audio signal by a factor of 30 and satisfies
the following specifications given below

   i. Input sampling frequency: 280KHz
  ii. Highest frequency of interest in the data: 3.8KHz
 iii. Pass band ripple: 0.04
  iv. Stop band ripple: 0.02
   v. D = 15 X 2

b. Prove the Wiener Hopf equation and derive the expression for MSE and Minimum value **10**
of MSE.

Q3 a. Derive the relation of the output y(n) with the input x(n) (time domain relation) for an
a. Interpolator for an integer factor I
b. Sampling rate convertor by a non-integer factor Also derive the spectrum of both.

b. Explain Yule-Walker method for AR model parameters

Q4 a. Prove the alias cancellation and perfect reconstruction condition for a 2 band quadrature **12**
filter bank in Haar MRA.

b. Consider an MA (1) process given below: **8**
$u(n) = v(n) - 0.4v(n-1)$
where v(n) is a zero mean white process with variance $\sigma_v^2 = 0.7$.
Obtain the parameters and Correlation matrix for an equivalent 2nd order AR process

Q5 a Compare Short Time Fourier transform and Spectrograms using the mathematical **6**
concepts and plots

b. Describe Welch method of determination of power spectrum estimate. **6**

c. Prove that the scaling function Ø(t) of Haar MRA is an orthogonal basis function. **4**

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Q6   **Write short notes on**
  a.   Steepest Descent method   **5**
  b.   DSP in the field of Speech signal processing   **5**
  c.   ARMA model of Spectrum Estimation   **5**
  d.   Non-parametric methods of Spectrum estimation   **5**

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