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First Semester M.Tech. Degree Examination, Feb./Mar. 2022
Advanced Digital Signal Processing

Time: 3 hrs.

Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. What is maturate digital signal processing? Derive the equations of the timing relations for the sampling rate conversions. **(10 Marks)**

   b. Describe the method of sampling rate conversion by rational factor I/D with block diagram. **(10 Marks)**

OR

2 a. How the suband coding is usefull for sampling rate conversion? Explain the suband coding of speech signals. **(10 Marks)**

   b. Explain the two channel Quadrature Mirror Filter Bank (QMF). Suppose the polyphase matrix the three channel perfect reconstruction FIR QMF band is

$$P(z^3) = \begin{bmatrix} 1 & 1 & 2 \\ 2 & 3 & 1 \\ 1 & 2 & 1 \end{bmatrix}.$$

   Determine the analysis and synthesis filters in the QMF bank. **(10 Marks)**

Module-2

3 a. What is random process? Explain stationary random processes and statistical averages. **(10 Marks)**

   b. Explain the method of predicting a future value with block diagram of forward linear predication and necessary equations. **(10 Marks)**

OR

4 a. Derive an expression for the prediction of coefficient using Levin's an Durbin algorithm. **(10 Marks)**

   b. Explain the properties of the linear prediction error filters. **(10 Marks)**

Module-3

5 a. Determine the equation to calculate the coefficient of an adaptive echo canceller based on the least square criterion for modems? Explain. **(10 Marks)**

   b. Explain adaptive noise cancellation with an example. **(10 Marks)**

OR

6 a. Write a note on linear predictive coding of speech signals. **(10 Marks)**

   b. Derive the expression for minimum mean square error criterion for optimum filter coefficient. **(10 Marks)**

Module-4

7 a. How the non parametric methods used for power spectrum estimation. Explain Welch method for Averagin modified periodograms. (10 Marks)

   b. Write a note on ARMA model spectrum estimation. (10 Marks)

OR

8 a. Autocorrelation value $\gamma_{yy}(0) = 3$, $\gamma_{yy}(1) = 1$ and $\gamma_{yy}(2) = 0$ for a process consisting of a single sinusoid in additive a write noise. Determine the frequency, its power, and the variance of the additive noise. (10 Marks)

   b. Explain the relationship between the Autocorrelation and the model parameters with necessary equations. (10 Marks)

Module-5

9 a. Explain how the wavelets finding the new applications in wireless communication. (10 Marks)

   b. Write a note on wavelet transform to denote and define wavelet transform. (10 Marks)

OR

10 a. What is HAAR wavelets functions? Explain scaled Haar wavelets functions. (10 Marks)

   b. Write short notes on :
      i) Continuous Fourier transform
      ii) Continuous time frequency representation of signals. (10 Marks)

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