CBCS SCHEME

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20ECS12

First Semester M.Tech. Degree Examination, July/August 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 the need for multirate digital signal processing? Mention any two applications of multirate signal processing. **(06 Marks)**

b. Derive an expression for the spectrum of a downsampler with necessary equations and show the effect of aliasing through waveforms. **(10 Marks)**

c. If $H(z) = 1 + 4z^{-1} + 6z^{-2} + 3z^{-3}$, implement H(z) using polyphase filter structure. **(04 Marks)**

OR

2 a. Derive the expression for the spectrum of an upsampler with necessary equations. **(07 Marks)**

b. Explain two channel quadrature mirror filter bank with a neat block diagram. Also derive necessary equations in matrix for the two filter. **(07 Marks)**

c. Explain the two noble identities of filter. **(06 Marks)**

Module-2

3 a. Write a short note on the following:
i) Random process
ii) Statistical ensemble average
iii) Power density spectrum
iv) Mean ergodic process. **(10 Marks)**

b. Define the following:
i) Autoregressive process
ii) Moving average process
iii) Autoregressive, Moving average process. **(10 Marks)**

OR

4 a. Derive the Yule-Walker equation in matrix form. **(10 Marks)**

b. Derive the expression for normal equations for a forward linear predictor with necessary equations and algorithm. **(10 Marks)**

Module-3

5 a. With a neat block diagram, explain the importance of adaptive filters in digital signal processing. **(04 Marks)**

b. With a neat block diagram, explain adaptive channel equalizer. **(06 Marks)**

c. Explain steepest descent method in determining the minimum mean square error with relevant graph. Also, deduce the Weiner Hopf equation. **(10 Marks)**

OR

6 a. With a neat block diagram, explain the principle of linear predictive coding for speech signals. Also estimate the pole parameters by applying the least-square criterion. **(10 Marks)**

b. Explain recursive least square algorithm with necessary equations. **(10 Marks)**

Module-4

7 a. Explain Periodogram and its importance in the estimation of power spectrum. **(04 Marks)**

b. Explain the steps involved in the calculation of power spectrum using Bartlett method. **(08 Marks)**

c. Compare the performance characteristics of non parameter power spectrum estimators with proper justifications. **(08 Marks)**

OR

8 a. Explain the ARMA model for power spectrum estimation. **(07 Marks)**

b. Explain the unconstrained least-square method for the AR-Model parameters. **(07 Marks)**

c. Explain the least-squares modified Yule-walker method for an ARMA model to estimate power spectrum. **(06 Marks)**

Module-5

9 a. Discuss the history of wavelets and also mention the applications of wavelets in signal processing. **(07 Marks)**

b. List out the mathematical preliminaries to obtain the wavelet transform. **(07 Marks)**

c. List the properties of wavelets. **(06 Marks)**

OR

10 a. Explain Haar scaling function and Haar wavelet function. **(10 Marks)**

b. Write a note on Daubechies wavelets. **(06 Marks)**

c. Explain the steps involved in the normalization of Haar bases at different scales. **(04 Marks)**

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