CBCS SCHEME

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First Semester M.Tech. Degree Examination, Dec.2019/Jan.2020
Advanced Digital Signal Processing

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. What is the need for multirate signal processing? Explain decimation and interpolation process, with examples. **(04 Marks)**

b. Derive the expression for the spectrum of a down sampler. **(10 Marks)**

c. If $H(z) = 1 + 2z^{-1} + 3z^{-2} + 4z^{-3}$ implement H(z) using polyphase filter structure. **(06 Marks)**

OR

2 a. Discuss the two noble identities used for interchanging of filters. **(10 Marks)**

b. Discuss uniform DFT filter bank and IDFT filter bank with relevant equations. **(10 Marks)**

Module-2

3 a. Write a short note on the following :

(i) Random process.
(ii) Power density spectrum.
(iii) Mean Ergodic process.
(iv) Statistical average for joint random process. **(10 Marks)**

b. Derive the expression for forward linear predictor using relevant equations. **(10 Marks)**

OR

4 a. For a given linear system with a rational system function H(z), if the output x(n) is related to the input w(n) by a difference equation,

$$x(n) + \sum_{K=1}^{P} a_K x(n-K) = \sum_{K=0}^{N} b_K W(n-K),$$

Define autoregress process, moving average process and autoregressive, moving average process (ARMA) with relevant difference equations. **(06 Marks)**

b. If $y(n) = x(n) + \frac{2}{3}x(n-1) + \frac{2}{5}x(n-2)$

find K_1 and K_2 in the lattice structure of a FIR filter. **(04 Marks)**

c. Derive the expression for backward linear filter. **(10 Marks)**

Module-3

5 a. Explain the principles of adaptive channel equalization with a neat block diagram. **(10 Marks)**

b. Explain the steps involved in Levinson Durbin Algorithm for deriving the expression for Normal equations. **(10 Marks)**

OR

6 a. What is minimum mean square criteria? Hence derive Wiener Hopf equation. **(10 Marks)**

b. Explain least mean square (LMS) algorithm with necessary steps. **(10 Marks)**

Module-4

7 a. How is power spectrum estimated? Classify power spectrum estimation methods. **(04 Marks)**

b. Define Periodogram and express the steps involved in computing the periodogram. **(06 Marks)**

c. Explain Bartlett method for computing the average periodogram. **(10 Marks)**

OR

8 a. Explain the Burg method for computing the AR model parameters. **(10 Marks)**

b. Explain the ARMA model for power spectrum estimation. **(10 Marks)**

Module-5

9 a. Discuss the history of wavelets. Also mention the applications of wavelets in signal processing. **(04 Marks)**

b. What is wavelet transform? List out the mathematical preliminaries to obtain the wavelet transform. **(10 Marks)**

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

OR

10 a. What is Haar wavelet transform? Explain the steps involved in finding the norm of Haar wavelet function. **(10 Marks)**

b. Explain the importance of Daubechies wavelets with relevant equations. **(10 Marks)**

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