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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)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

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)
