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10EC123

M.Tech. Degree Examination, June/July 2011
Modern Digital Signal Processing

Time: 3 hrs.

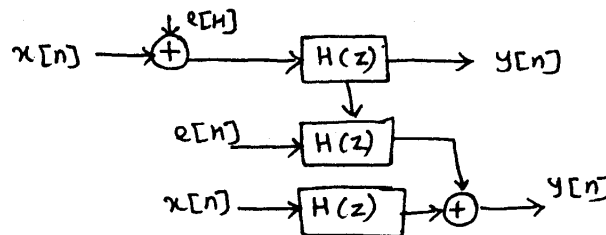
Max. Marks:100

Note: Answer any FIVE full questions.

- 1 a. Define z-transform. List and prove the properties of z-transform. (10 Marks)
- b. Consider the linear difference equation $y[n] - 2.5 y[n - 1] + y[n - 2] = x[n - 1]$
 - i) Determine the transfer function $H(z)$
 - ii) The given difference equation might represent a causal, anticausal or non causal system for each case determine the difference equation, the transfer function (with ROC) and whether the system is stable or not. (10 Marks)

- 2 a. Explain the prediction based sampling methods with necessary diagrams. (10 Marks)
- b. In the system below, let the signal $x[n]$ be affected by some random error $e[n]$ as shown in Fig.Q2(b). The error is white zero mean, with variance $\sigma_e^2 = 1.0$. Determine the variance of the error $\epsilon[n]$ after the filter for each of the following filters $H(z)$.
 - i) An ideal low pass filter $H(z)$ with bandwidth $\pi/4$.
 - ii) $H(z) = \frac{z}{z - 0.5}$
 - iii) $y[n] = \frac{1}{4} (s[n] + s[n - 1] + s[n - 2] + s[n - 3])$ with $s[n] = x[n] + e[n]$
 - iv) $H(w) = e^{-jw}$, for $-\pi < w < +\pi$ (10 Marks)

Fig.Q2(b)



- 3 a. Differentiate between FIR and IIR systems with suitable examples. (08 Marks)
- b. Explain the design of FIR filters using windowing technique with appropriate expression and sketches. (12 Marks)
- 4 a. Explain the elementary operations of the digital filter implementation. (10 Marks)
- b. Explain a general state space representation of an IIR filter. (10 Marks)
- 5 a. Explain the analysis of downsampling and upsampling. (10 Marks)
- b. Write a short note on the application of multirate DSP. (10 Marks)
- 6 a. Explain the maximally decimated DFT filter banks. (10 Marks)
- b. Explain the time division multiple access (TDMA) and frequency division multiplexing techniques in Transmultiplexers. (10 Marks)
- 7 Determine conditions on the four impulse responses $g[n]$, $h[n]$, $\tilde{g}[n]$, $\tilde{h}[n]$ in the time domain as well as in the transform domain. (20 Marks)
- 8 a. Explain the lattice implementation of orthonormal filter banks. (12 Marks)
- b. Write short note on wavelet transform. (08 Marks)

Important Note : 1. On completing your answers, carefully 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.

