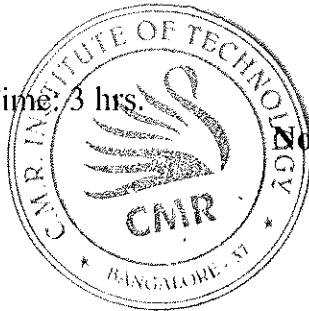


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Fifth Semester B.E. Degree Examination, June/July 2016
Digital Signal Processing

Time: 3 hrs.

Max. Marks:100



Note: Answer any FIVE full questions, selecting at least TWO questions from each part.

PART – A

- 1 a. Derive the expression for DFT and IDFT. (10 Marks)
- b. Find the 6 point DFT of the sequence $x(n) = \{1, 1, 2, 2, 3, 3\}$. Compute the corresponding magnitude and phase angle. (10 Marks)
- 2 a. State and prove the following DFT properties :
 - i) Time shift property
 - ii) Periodicity property
 - iii) Multiplication of 2 sequences in time domain. (10 Marks)
- b. Find the response of an FIR filter with impulse response $h(n) = \{1, 2, 4\}$ to the input/output sequence $x(n) = \{1, 2\}$. Mention the property used. Use DFT and IDFT method for computation. (10 Marks)
- 3 a. Use overlap add method to find $y(n) = x(n)*h(n)$ for the sequences $x(n) = \{1, 2, -1, 2, 3, -2, -3, -1, 1, 1, 2, -1\}$ and $h(n) = \{1, 2\}$. (10 Marks)
- b. Derive the (decimation in time)DFT- FFT algorithm. (07 Marks)
- c. What is the speed improvement factor in calculating 64 point DFT of a sequence using direct computation and FFT algorithm? (03 Marks)
- 4 a. Find the 8 point DFT of a continuous time signal $x(t) = \sin(2\pi ft)$; with $f = 50$ Hz. Use DIT – FFT algorithm. (10 Marks)
- b. Find the inverse DFT of the sequence using (decimation in frequency DIF radix – 2) algorithm for $x(k) = \{4, 1 - j2.414, 0, 1 - j0.414, 0, 1 + j0.414, 0, 1 + j2.414\}$. (10 Marks)

PART – B

- 5 a. For the given specification, design an analog Butterworth filter :

$$0.9 \leq |H(j\Omega)| \leq 1 \quad \text{for } 0 \leq \Omega \leq 0.2\pi$$

$$|H(j\Omega)| \leq 0.2 \quad \text{for } 0.4\pi \leq \Omega \leq \pi. \quad (08 \text{ Marks})$$
- b. Design a Chebyshev filter with maximum passband attenuation of 2.5 dB at $\Omega_p = 20$ rad/sec and the stopband attenuation of 30 dB at $\Omega_s = 50$ rad/sec. (12 Marks)
- 6 a. Obtain the cascaded and parallel realization of :

$$H(z) = \frac{1 + \frac{1}{4}z^{-1}}{(1 + \frac{1}{2}z^{-1})(1 + \frac{1}{2}z^{-1} + \frac{1}{4}z^{-2})}. \quad (08 \text{ Marks})$$
- b. Convert the following pole zero IIR filter into a lattice ladder structure :

$$H(z) = \frac{1 + 2z^{-1} + 2z^{-2} + z^{-3}}{1 + \frac{13}{24}z^{-1} + \frac{5}{8}z^{-2} + \frac{1}{3}z^{-3}}. \quad (12 \text{ Marks})$$

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. 4.2+8 = 50, will be treated as malpractice.

- 7 a. Design an ideal highpass filter with the frequency response

$$H_d(e^{j\omega}) = 1 \quad \frac{\pi}{4} \leq |\omega| \leq \pi$$
$$= 0 \quad |\omega| < \frac{\pi}{4}$$

Use a Hamming window with $N = 11$.

(15 Marks)

- b. What is the need for employing window technique for FIR filter design? Draw the frequency response of N – point rectangular window.

(05 Marks)

- 8 a. For the analog transfer function $H(s) = \frac{2}{(s+1)(s+2)}$ determine $H(z)$ using : i) impulse invariance method ii) Bilinear transformation method. Assume $T = 1$ sec. (10 Marks)
- b. Explain the approximation of derivative method for digitizing the analog filter to digital filter. (10 Marks)
