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10TE52

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 atleast 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 (2πft) ; 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 :
$0.9 \le |H(j\Omega)| \le 1$ for $0 \le \Omega \le 0.2\pi$
$|H(j\Omega)| \le 0.2$ for $0.4\pi \le \Omega \le \pi$. **(08 Marks)**

b. Design a Chebyshev filter with maximum passband attenuation of 2.5 dB at $\Omega_p = 20$ mad/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 :

$$H(z) = \frac{1 + \frac{1}{4}z^{-1}}{(1 + \frac{1}{2}z^{-1})(1 + \frac{1}{2}z^{-1} + \frac{1}{4}z^{-2})}.$$ **(08 Marks)**

b. Convert the following pole zero IIR filter into a lattice ladder structure :

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

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)**

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