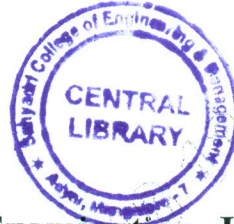


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10EC52

**Fifth Semester B.E. Degree Examination, June/July 2018**  
**Digital Signal Processing**

Time: 3 hrs.

Max. Marks: 100

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

**PART - A**

- 1 a. Derive the DFT expression from the DTFT expression. (06 Marks)  
 b. Compute 5-point DFT of  $x(n) = \{1, 1, 1\}$ . (07 Marks)  
 c. Find IDFT for the sequence,  $X(K) = \{5, 0, (1-j), 0, 1, 0, (1+j), 0\}$  (07 Marks)
- 2 a. State and prove circular time shift and frequency shift property of DFT. (05 Marks)  
 b. Determine N-point circular correlation of  $x_1(n)$  and  $x_2(n)$ , given  $x_1(n) = \cos \frac{2\pi}{N}n$  and  $x_2(n) = \sin \frac{2\pi}{N}n$ . (08 Marks)  
 c. Compute circular convolution of  $x(n) = \{1, 2, 3, 4\}$  and  $h(n) = \{1, 2, 2\}$  using time domain approach. (07 Marks)
- 3 a. Find the output  $y(n)$  of a filter whose impulse response  $h(n) = \{1, 2\}$  and the input signal to the filter is,  $x(n) = \{1, 2, -1, 2, 3, -2, -3, -1, 1, 1, 2, -1\}$  using overlap - save method. (08 Marks)  
 b. Find 4-point DFT of two real sequences using a single 4-point DFT, given  $g(n) = \{1, 2, 0, 1\}$  and  $h(n) = \{2, 2, 1, 1\}$ . (08 Marks)  
 c. State and prove (i) Symmetry and (ii) Periodicity property of a twiddle factor. (04 Marks)
- 4 a. Develop Radix-2, DITFFT algorithm to compute DFT of a sequence, draw the signal flow graph, for  $N = 8$ . (08 Marks)  
 b. Obtain 8-point DFT of a sequence  $x(n) = (n+1)[u(n) - u(n-8)]$ , using DIF-FFT algorithm, show all the intermediate results. (08 Marks)  
 c. Write a note on Geortzal algorithm. (04 Marks)

**PART - B**

- 5 a. Derive an expression for order and cutoff frequency of a Butterworth low pass filter. (06 Marks)  
 b. Design an analog Chebyshev filter having following specifications:  
 (i) Passband ripple of 3 dB at 500Hz. (10 Marks)  
 (ii) Attenuation of 15 dB at 750 Hz. (04 Marks)  
 c. Compare Butterworth and Chebyshev filters.
- 6 a. Obtain the cascade and parallel form realization of,  

$$H(z) = \frac{8z^3 - 4z^2 + 11z - 2}{\left(z - \frac{1}{4}\right)\left(z^2 - z + \frac{1}{2}\right)}$$
 (10 Marks)  
 b. A FIR filter is described by Transfer function,  $H(z) = 1 + \frac{2}{5}z^{-1} + \frac{3}{4}z^{-2} + \frac{1}{3}z^{-3}$ ,  
 (i) Draw Lattice structure.  
 (ii) Obtain its difference equation.  
 (iii) Draw Direct form structure. (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.

- 7 a. Derive an expression for frequency response of a symmetric FIR filter, for  $N = \text{odd}$ . (08 Marks)
- b. Design a LPF with the frequency response,  $H_d(j\omega) = \begin{cases} e^{-j2\omega}, & |\omega| < \frac{\pi}{4} \\ 0, & \frac{\pi}{4} < |\omega| < \pi \end{cases}$  using rectangular window. Also find its impulse response and frequency response. (08 Marks)
- c. Explain the frequency sampling design of FIR filters. (04 Marks)
- 8 a. Derive the expression for the bilinear transformation, to transform an analog filter to digital filter, explain the characteristics of mapping from s-plane to z-plane. (08 Marks)
- b. Given the analog transfer function,  $H(s) = \frac{s+2}{(s+1)(s+3)}$ , find  $H(z)$  using matched z-transform. (04 Marks)
- c. Design a digital lowpass filter using Bilinear transformation to satisfy the following characteristics:
- (i) Monotonic stopband and passband.
  - (ii) -3 dB cutoff frequency of  $0.5\pi$  rad.
  - (iii) Magnitude down at least 15 dB at  $0.75\pi$  rad.
- (08 Marks)

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