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**06EE64**

# Sixth Semester B.E. Degree Examination, June/July 2017
## Digital Signal Processing

Time: 3 hrs. Max. Marks:100

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



### PART – A

1 a. Find the 4-point DFT of the sequence : $x(n) = \cos n\frac{\pi}{4}$. **(04 Marks)**

b. Discuss the following properties of DFT : i) periodicity ii) time reversal iii) linearity. **(08 Marks)**

c. Determine the 8 – point DFT of the sequence : x(n) = {1, 1, 1, 1, 1, 1, 0, 0}. **(08 Marks)**

2 a. Compute circular convolution using DFT and IDFT of the following sequences : x(n) = {2, 3, 1, 1}, $x_2(n)$ = {1, 3, 5, 3}. **(08 Marks)**

b. Perform x(n) ∗ h(n) for the sequences : x(n) = {1, 2, 0, 3, 4, 2, -1, 1} and h(n) = {1, 1, 1} by using overlap–save method. **(08 Marks)**

c. The five points of eh 8-point DFT of a real valued sequence are : x(0) = 0.25, x(1) = 0.125 – j0.3018, x(6) = 0, x(4) = 0, x(5) = 0.125 – j0.0158. Determine the remaining samples. **(04 Marks)**

3 a. Develop an 8-point DIT-FFT algorithm, draw the signal flow graph. **(06 Marks)**

b. Given x(n) = {1, 2, 3, 4, 3, 2, 1, 0}. Find x(k) using radix – 2 DIF-FFT algorithm. **(08 Marks)**

c. What is FFT? Give its importance in digital signal processing. **(06 Marks)**

4 a. Develop realization diagram for the system described by the system function given below in direct form – I and direct form – II.

$$H(z) = \frac{3 + 3.6^{-1} + 0.6z^{-2}}{1 + 0.1z^{-1} - 0.2z^{-2}}.$$ **(06 Marks)**

b. Given the system function : $H(z) = \frac{2 + 8z^{-1} + 6z^{-2}}{1 + 8z^{-1} + 12z^{-2}}$. Realize using ladder structure. **(08 Marks)**

c. Realize a linear phase FIR filter with the following impulse response. Give necessary equations : $h(n) = \delta(n) + \frac{1}{2}\delta(n-1) - \frac{1}{4}\delta(n-2) + \delta(n-4) + \frac{1}{2}\delta(n-3)$. **(06 Marks)**

### PART – B

5 a. The system function of the first order normalized lowpass filter is given as : $Hp(s) = \frac{1}{\delta + 1}$. Obtain the system function of second order bandpass filter having passband from 1 KHz to 2 KHz. **(05 Marks)**

b. Design a Butterworth analog highpass filter that will meet the following specification. maximum passband attenuation 2dB passband edge frequency 200 rad/sec, minimum stopband attenuation 20dB stopband edge frequency of 100 rad/sec. **(12 Marks)**

c. Discuss frequency transformations in analog domain. **(03 Marks)**

6 a. Design an along Butterworth filter that has a –2db or better cut off frequency of 20 rad/sec and at least 10dB of attenuation at 30 rad/sec. **(08 Marks)**

b. Design a lowpass 1 rad/sec bandwith Chebyshev filter with the following characteristics:
   i) Acceptable passband tipple of 2dB
   ii) Cutoff radian frequency of 1 rad /sec
   iii) Stopband attenuation of 20dB or greater beyond 1.3 rad/sec. **(08 Marks)**

c. The transfer function of analog filter in given as $H(s) = \frac{s+2}{(s+3)(s+1)}$. Find H(z) using impulse invariance method. **(04 Marks)**

7 a. Explain design of FIR filter using windowing technique with appropriate expression and sketches. **(10 Marks)**

b. The desired frequency response of a lowpass filter is given by :

$$H_d(\omega) = \begin{cases} e^{-3j\omega} & |\omega| \le 3\pi/ \\ 0 & 3\pi/4 \le |\omega| \le \pi \end{cases}$$

.Determine the frequency response of the FIR filter if a Hamming window in used. **(10 Marks)**

8 a. Determine the impulse response h(n) of a filter having desired frequency response,

$$H_d(e^{j\omega}) = \begin{cases} e^{-j(N-1)\omega/2} & \text{for } 0 \le |\omega| \le \pi/2 \\ 0 & \pi/2 \le |\omega| \le \pi \end{cases}$$

N = 7, Use frequency sapling approach. **(10 Marks)**

b. With neat block diagram, explain the architecture of fixed point DSP processor. **(10 Marks)**

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