B.E. Electronics Engineering Seven Semester CBS

EN703 - Digital Signal Processing

P. Pages : 2 **GUG/W/18/1784**

Time : Three Hours * 1 3 9 5 * Max. Marks : 80

Notes : 1. All questions carry equal marks.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Illustrate your answers wherever necessary with the help of neat sketches.

1. a) Find circular convolution of **16**
$x_1(n) = \{1, 2, 1, 2\}$
$x_2(n) = \{4, 3, 2, 1\}$
using DFT and IDFT technique.

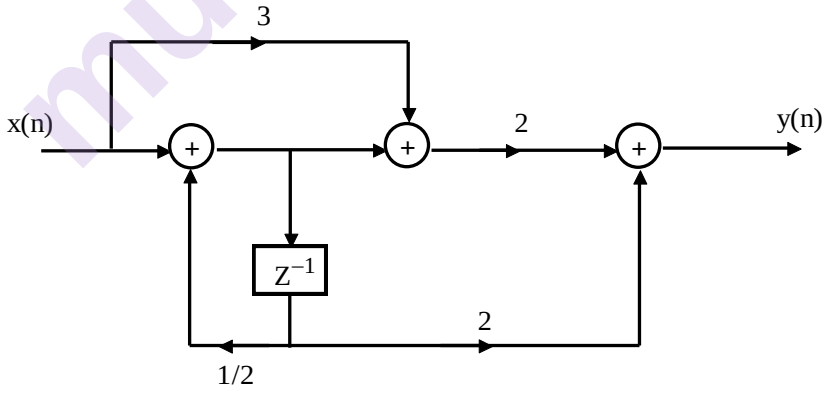
OR

2. a) Compute 8 point DFT of the sequence **10**
x(n) = {1, 1, 1, 1, 2, 4, 6, 8} using Radix-2 DIT FFT algorithm.

b) Find linear convolution of $x_1(n) = \{2, 1\}$ and $x_2(n) = \{1, 3\}$ using DFT and IDFT technique. **6**

3. a) Obtain parallel and transposed structure for the following system. **8**
$y(n) = -0.1y(n-1) + 0.2y(n-2) + 3x(n) + 3.6x(n-1) + 0.6x(n-2)$

b) Determine the system function and the impulse response of the system shown in fig.Q.3(b). **8**



OR

4. Obtain direct form I, direct form II, cascade and parallel structures for the following. **16**

$$H(z) = \frac{2(1-z^{-1})(1+\sqrt{2}\,z^{-1}+z^{-2})}{(1+0.5z^{-1})\,(1-0.9z^{-1}+0.81z^{-2})}$$

5. Estimate the order of a linear phase low pass FIR filter with the following specifications **16**
Passband Edge, F_p = 1.8 kHz
Stopband Edge, F_s = 2 kHz
Peak passband ripple A_p = 0.1 dB
Minimum stopband attenuation, A_s = 35 dB
and sampling rate F_s = 12 kHz. Also obtain first 5 filter coefficients using rectangular window.

OR

6. Design a FIR bandpass filter to pass frequencies in the range 1.5 kHz to 3 kHz and sampling frequency of 8 kHz with 7 samples using Fourier series method. **16**

7. Obtain an analog Chebyshev filter transfer function that satisfies the constraints **16**

$$\frac{1}{\sqrt{2}} \le |H(j\Omega)| \le 1 \; ; \; 0 \le \Omega \le 2$$

$$|H(j\Omega)| < 0.1 \; , \; \Omega \ge 4$$

OR

8. a) Derive an expression for poles of Butterworth analog filter. **8**

b) Obtain normalized transfer function of Butterworth filter for order N = 8. **8**

9. Explain with an example what do you understand by -
a) Decimation by a factor D **8**

b) Interpolation by a factor I **8**

OR

10. a) Consider the signal $x(n) = a^n u(n), |a| < 1$. Determine the spectrum X(w) **8**

b) Consider the discrete time signal **8**
x(n) = {1, 2, 3, 4, 5, 6, 7, 8, 6, 5, 4, 3}
Determine the down sampled version of the signal for sampling rate reduction factor
i) D = 2
ii) D = 3
iii) D = 4

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