CBCS SCHEME

USN | | | | | | | | | |

15EE63

Sixth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Digital Signal Processing

Time: 3 hrs. Max. Marks: 80

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Find 4 point DFT of $x(n) = \{1, -2, 3, 4\}$ and plot magnitude and phase response. **(06 Marks)**

b. If $x_1(n) = \{2, 3, 1, 1\}$ and $x_2(n) = \{1, 3, 5, 3\}$, find $x_3(n) = x_1(n)$ ④ $x_2(n)$ use matrix method **(06 Marks)**

c. Prove the time reversal property of DFT. **(04 Marks)**

OR

2 a. Perform circular convolution of $x_1(n) = \{2, 1, 2, 1\}$ and $x_2(n) = \{1, 2, 3, 4\}$ using circular shift method. **(05 Marks)**

b. Find linear convolution using DFT for the given sequence $x(n) = \{1, 2, 3\}$ $h(n) = \{1, 2, 2, 1\}$. **(06 Marks)**

c. Find the IDFT of the given sequence $x(k) = \{3, 2 + j, 1, 2 - j\}$. **(05 Marks)**

Module-2

3 a. Find the 8-point DFT of sequence $x(n) = \{1, 1, 1, 1, 0, 0, 0, 0\}$ using DIT FFT radix 2 algorithm. Draw signal graph. **(08 Marks)**

b. Develop a Decimation in Frequency FFT algorithm for N = 8. Draw signal flow graph. **(08 Marks)**

OR

4 a. Develop a decimation in time algorithm FFT of N = 8 draw signal flow graph. **(08 Marks)**

b. Calculate 8-point DFT of sequence $x(n) = \{1, -1, -1, -1, 1, 1, 1, -1\}$, using DIF – FFT radix -2 algorithm. **(08 Marks)**

Module-3

5 a. Design an analog Chebyshev with following specification.
Passband : 1db for $0 \le \Omega \le 10$ rad/sec
Stopband attenuation : -60 db for $\Omega \ge 50$ rad/sec. **(10 Marks)**

b. The system function of an analog filter is given as $H_a(s) = \dfrac{1}{(s+1)(s+2)}$. Obtain H(z) using impulse invariant method take sampling frequency as 5 samples/sec. **(06 Marks)**

OR

6 a. Design a low pass Butterworth filter using bilinear transformation method to meet the following specification take T = 2sec
Passband ripple $\le$ 1.25dB
Passband edge = 200 Hz
Stopband attenuation $\ge$ 15dB
Stopband edge = 400Hz
Sampling frequency = 2KHz **(10 Marks)**

b. Prove the following transformation relation for impulse invariant transform.

$$\frac{s+a}{(s+a)^2+b^2} = \frac{1-e^{aT}(\cos bT)z^{-1}}{1-2e^{-aT}(\cos bT)z^{-1}+e^{-2aT}z^{-2}}$$ **(06 Marks)**

Module-4

7 a. Compare bilinear transformation with impulse invariance transformation. (04 Marks)

b. Write a note on frequency warping. (06 Marks)

c. Determine Direct form – I and II for 2^{nd} order filter given by
$y(n) = 2b \cos w_0\, y(n-1) - b^2 y(n-2) + x(n) - b \cos w_0\, x(n-1)$ (06 Marks)

OR

8 a. Obtain the Cascade form realization for given system.

$$H(z) = \frac{(z-1)(z-2)(z+1)z}{\left(z-\frac{1}{2}-\frac{1}{2}j\right)\left(z-\frac{1}{2}+\frac{1}{2}j\right)\left(z-\frac{1}{4}j\right)\left(z+\frac{1}{4}j\right)}$$ (08 Marks)

b. Design a second order lowpass digital Butterworth filter with cutoff frequency 1KHz and sampling frequency of 10^4 samples/sec by linear transformation. (08 Marks)

Module-5

9 a. Given the FIR filter with following deference equation
$y(n) = x(n) + \frac{2 \cdot x}{5}(n-1) + \frac{3}{4}x(n-2) + \frac{1}{3}x(n-3)$. Draw direct Form – I and lattice structure. (08 Marks)

b. Using frequency sampling method, design a band pass filter with following specification determine the filter coefficient for N = 7, sampling frequency F = 8000Hz, cutoff frequency $f_{c_1} = 1000\text{Hz}$, $f_{c_2} = 3000\text{Hz}$ (08 Marks)

OR

10 a. Realise the following system function in cascade form
$H(z) = 1 + \frac{3}{4}z^{-1} + \frac{17}{8}z^{-2} + \frac{3}{4}z^{-3} + z^{-4}$ in direct form I and cascade form. (08 Marks)

b. Design the symmetric FIR lowpass filter whose desired frequency response is given as

$$H_d(\omega) = \begin{cases} e^{-j\omega z}, & \text{for } |\omega| \le \omega_c \\ 0, & \text{otherwise} \end{cases}$$

The length of filter should be 7 and ω_c = 1 rad/sample use rectangular window. (08 Marks)

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