Code: 15A04603 **R15**

B.Tech III Year II Semester (R15) Supplementary Examinations December/January 2018/19

DIGITAL SIGNAL PROCESSING

(Common to ECE & EIE)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) If DFT of x(n) is X(k), what is the DFT of x(n-1).
(b) Define circular convolution.
(c) How many computations are required for finding 1024 point DFT using FFT?
(d) Define correlation of two sequences.
(e) Sketch the direct form II realization for a first order IIR digital filter.
(f) What is a transposed structure?
(g) Write two important differences between FIR and IIR filters.
(h) Mention two commonly used analog filters.
(i) What is decimation? Sketch a signal and its signal decimated by 2.
(j) Mention few applications of multi rate signal processing.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 Find the DFT of the sequence $x(n) = \left(\frac{1}{4}\right)^n$ for N = 16.

OR

3 (a) State and prove the time shifting property of DFT.
(b) Find the 3 point DFT of $h(n) = \frac{1}{3}\ for\ 0 \le n \le 2$.

UNIT – II

4 Compute the 8 point DFT of the sequence x(n) = {0.5, 0, 0.5, 0, 0.5, 0, 0.5, 0} using DIT-FFT algorithm.

OR

5 Explain with flow diagram the computation of split radix FFT for radix 6.

UNIT – III

6 (a) Realize the system $H(z) = 1/2 + 1/3\ z^{-1} + z^{-2} + 1/4\ z^{-3} + z^{-4} + 1/3\ z^{-5} + 1/2\ z^{-6}$ in direct form.
(b) Draw the structure of a single stage and two stage all-zero lattice FIR filter.

OR

7 Obtain the cascade form of realization for the system:

$$y(n) + 0.1\ y(n-1) = 0.2\ y(n-2) + 3\ x(n) + 3.6\ x(n-1) + 0.6\ x(n-2)$$

UNIT – IV

8 Determine the filter coefficients h(n) of a FIR filter obtained by frequency sampling method for N = 7, given:

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

OR

9 Determine H(z) given H(s) = 1 / (s^2 + 7s + 10) using: (i) Impulse invariant transformation. (ii) Bilinear transformation method. Assume T = 0.2 sec.

UNIT – V

10 Describe the process of interpolation. With necessary equations and explain the spectrum of the interpolated signal.

OR

11 Explain with block diagrams multi stage implementation of decimator and interpolator.

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Code: 15A04603 **R15**

B.Tech IV Year I Semester (R15) Regular Examinations November/December 2018

DIGITAL SIGNAL PROCESSING

(Electrical & Electronics Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Define sampling theorem.
(b) Write any two properties of DFT.
(c) What are twiddle factors?
(d) Mention few applications of FFT algorithm.
(e) Write any two properties of FIR systems.
(f) When cascade form of realization is preferred in FIR filter?
(g) What are the desirable characteristics of windows?
(h) List the properties of bilinear transformation.
(i) What is an anti-imaging filter?
(j) What is the function of decimator?

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 Find DFT of the following sequence: x(n) = (1,1,1,1,0,0,0,0)

OR

3 Determine the convolution of the following signal sequences:

$x(n) = 2^n u(n), \quad h(n) = (1/2)^n u(n)$

UNIT – II

4 Obtain an 8 point DFT of the following sequences using DIF algorithm:

x(n) = (1,2,3,2,1,2,3,2)

OR

5 Obtain IDFT of the following sequences using DIT algorithm:

$X(k) = (5,0,1-j,0,1,0,1+j,1-j2)$

UNIT – III

6 Obtain linear phase realization for the following system:

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

OR

7 Obtain the direct form I, direct form II and cascade form realization of the following system function:

$$y(n) = -0.1y(n-1) + 0.2y(n-2) + 3x(n) + 3.6x(n-1) + 0.6x(n-2)$$

UNIT – IV

8 Design a Band Pass Filter using Hanning window with N=5. The desired frequency response is given by:

$$H_d(\omega) = \begin{cases} e^{-j2\omega}; (-2 \le \omega \le -1)(1 \le \omega \le 2) \\ 0; \qquad\qquad elsewhere \end{cases}$$

OR

9 Design a Chebyshev filter for the following specifications using Bilinear transformation:

$0.8 \le |H(\omega)| \le 1.0; 0 \le \omega \le 0.2\pi$

$|H(\omega)| \le 0.2; 0.6\pi \le \omega \le \pi$

Assume T = 1 second.

UNIT – V

10 With necessary equations and diagrams, explain about the interpolation and decimation in multirate signal processing.

OR

11 A sequence x(n) corresponds to samples of a band limited signal using a sampling frequency of 10 kHz. However, the sequence should have been sampled using a sampling frequency 12 kHz. Design a system for digitally changing the sampling rate.

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