Code: 13A04602 **R13**

B.Tech IV Year I Semester (R13) Supplementary Examinations June 2018

DIGITAL SIGNAL PROCESSING

(Electrical and 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) Find the energy of a signal:

$x(n) = \sin(\pi n) \quad -4 \le n \le 4$

$= 0 \quad otherwise$

(b) Find the 10-point inverse DFT of:

$X(k) = 3 \quad k = 0$

$= 0 \quad 1 \le n \le 9$

(c) Differentiate between fixed radix and mixed radix algorithms.

(d) Assuming each complex multiplication take $1\ \mu\ sec$ and then compute time taken for DFT computation directly and by using FFT. Assume N = 1024.

(e) Which elements are used for implementation of discrete time systems and justify their use?

(f) Which factors will influence the choice of filter structure?

(g) Justify FIR filter is always stable.

(h) Compare impulse invariant and bilinear transformation methods.

(i) Illustrate the effect of decimation and interpolation on number of samples of a sequence.

(j) State few applications of multirate DSP.

PART – B

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

UNIT – I

2 Check the following systems for linearity and time invariance:

(i) $y(n) = 3^n\ x(n)$.

(ii) $y(n) = e^{x(n)}$.

OR

3 Given the two sequences of length '4' as under, find response of system:

$x(n) = \{1, 2, 3, 1\}$

$h(n) = \{4, 3, 2, 2\}$

Verify the answer using DFT method.

UNIT – II

4 Find the 8-point DFT of a sequence $x(n) = (1,2,3,4,4,3,2,1)$ using DIT-FFT radix-2 algorithm.

OR

5 Find the 8-point DFT of a sequence $x(n) = (1,1,1,1,0,0,0,0)$ using DIF-FFT radix-2 algorithm.

UNIT – III

6 Realize system with following difference equation in Cascade and Parallel:

$y(n) = -0.1\ y(n-1) + 0.72\ y(n-2) + 0.7x(n) - 0.252\ x(n-2)$

OR

7 Realize system with following difference equation in Direct form – I and Direct form – II.

$y(n) = -0.1\ y(n-1) + 0.2\ y(n-2) + 3x(n) + 3.6x(n-1) - 0.252\ x(n-2)$

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UNIT – IV

8 Determine the H(z) for a Butter worth filter satisfying following frequency specifications:

$(0.5)^{1/2} \leq |H(e^{jw})| \leq 1 \qquad 0 \leq \omega \leq \pi/2$

$|H(e^{jw})| \leq 0.2 \qquad 3\pi/4 \leq \omega \leq \pi$

Assume T = 1 sec. Use impulse invariant method.

OR

9 Design a band pass filter to pass frequencies in the range of $1 - 2$ rad/sec use Hamming window with N = 5.

$$H_d(e^{j\omega}) = e^{-j\alpha\omega} \qquad \omega_{C_1} \leq \omega \leq \omega_{C_1}$$
$$= 0 \qquad otherwise$$

Also find $H(e^{j\omega})$.

UNIT – V

10 Explain the concept of decimation with the help of waveform illustrations in frequency domain.

OR

11 Explain the concept of interpolation with the help of waveform illustrations in frequency domain.

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