Code No: 127CK **R15**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech IV Year I Semester Examinations, May/June - 2019
DIGITAL SIGNAL PROCESSING
(Electrical and Electronics Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

(25 Marks)

1.a) Define time invariant system. [2]
b) Determine the Z – transform of $x(n) = (n-3)\,u(n)$ [3]
c) Calculate the DFT of the sequence where x(n) ={1,1,-2,-2} [2]
d) Compare the DIT and DIF radix-2 FFT. [3]
e) What are the advantages and disadvantages of bilinear transformation? [2]
f) How will you determine the order *N* of Chebyshev filter? [3]
g) Write the characteristic features of rectangular window. [2]
h) Explain the procedure for designing FIR filters using windows. [3]
i) What are the two basic operations in multi-rate signal processing? [2]
j) If $x(n) = \{1, -1, 3, 4, 0, 2, 5, 1, 6, 9, \ldots\}$, what is $y(n) = x(2n)$, $y(n) = x(3n)$? [3]

PART-B

(50 Marks)

2. Test the stability of the following systems.
(a) $y(n) = \cos(x(n))$ (b) $y(n) = x(-n-3)$ (c) $y(n) = nx(n)$ [10]

OR

3. The transfer function of a system is given by, $H(z) = \frac{1}{1-0.5z^{-1}} + \frac{1}{1-2z^{-1}}$ Determine the stability and causality of the system for a) ROC : $|z| > 2$; b) ROC : $|z| < 0.5$.[10]

4. An 8 – point sequence is given by x(n) ={2,1,2,1,1,1,2,1}. Compute 8 –point DFT of x(n) by radix -2 DIT FFT . Also sketch the magnitude and phase spectrum. [10]

OR

5. If IDFT $\{X(k)\} = x(n) = \{1, 2, 1, 0\}$, using properties of DFT, find
a) IDFT $\{X(k-1)\}$
b) IDFT $\{X(k)\,X(k)\}$
c) Signal energy. [10]

6. Design a low-pass Butterworth filter using the bilinear transformation method for satisfying the following constraints:

Pass band: 0–400 Hz — Stop band: 2.1–4 kHz
Pass band ripple: 2 dB — Stop band attenuation: 20 dB
Sampling frequency: 10 kHz [10]

OR

7. Design a Chebyshev IIR digital low-pass filter to satisfy the constraints.

$$0.707 \le |H(w)| \le 1 \quad for \quad 0 \le w \le 0.2\ \pi$$

$$|H(w)| \le 0.1, \quad for \quad 0.5\ \pi \le w \le\ \pi$$

using bilinear transformation and assuming $T = 1$ s. [10]

8. Design a linear phase FIR high pass filter using hamming window, with a cutoff frequency, $w_c = 0.8\ \pi$ rad /sample and N = 7. [10]

OR

9.a) Write the characteristic features of triangular window.
b) Compare the Hamming and Blackman windows.
c) List the features of Hanning window spectrum. [10]

10. Show that the transpose of a factor of D decimator is a factor of D interpolator if the transpose of a factor of D down sampler is a factor of D up sampler. [10]

OR

11.a) Explain about Computational Output Round-off Noise.
b) Discuss in briefly about Round-off Noise in IIR Digital Filters. [5+5]

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