Code No: 126VK **R15**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year II Semester Examinations, December - 2018

DIGITAL SIGNAL PROCESSING

(Common to ECE, EIE)

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) What are the properties of frequency response $H(e^{j\omega})$ of an LTI system? [2]

b) What is the relation between Z-transform and DTFT? [3]

c) What is zero padding? What are its uses? [2]

d) Distinguish between linear convolution and circular convolution of two sequences. [3]

e) What is warping effect? What are its effect on magnitude and phase response? [2]

f) What are the properties of Chebyshev filter? [3]

g) What is the basis for Fourier series methods of design? Why truncation is necessary? [2]

h) What is the frequency of designing FIR filter using frequency sampling method? [3]

i) What is the need for anti-aliasing filter prior to downsampling? [2]

j) What are the methods to prevent overflow? [3]

PART - B

(50 Marks)

2.a) Determine the stability for the following systems and test the causality.

$$h(n) = u(n); h(n) = 4^n u(2-n); h(n) = 2^n u(n); h(n) = e^{-6}|n|; h(n) = 5^n u(3-n)$$

b) For each impulse response listed below, determine whether the corresponding system is (i) causal (ii) stable.

$h(n) = \delta(n) + \sin \pi n$ [6+4]

OR

3.a) Find the z-transform and ROC of the following sequence

(i) $(-1)^n \cos\left(\frac{\pi}{3} n\right) u(n)$ (ii) $x(n) = (0.25)^n u(n) + (0.5)^n u(n)$

b) Determine H(z) for the given systems. Discuss stability, and if possible determine $H(e^{jw})$ from H(z). [5+5]

$$y(n) + y(n-1) + 2y(n-2) = x(n)$$

4.a) State and prove any two properties of Discrete Fourier series.

b) Find 8-point DFT of the sequence $x(n) = \cos\frac{n\pi}{4}$. [4+6]

OR

5.a) Given $x(n) = 2^n$ and N=8, find X(k) using DIT-FFT algorithm.

b) Find the 8-point DFT of the given sequence $x(n) = \{7,6,5,4,3,2,10\}$. [5+5]

6. Design a digital Butterworth filter satisfying the constraints:

$$0.75 \le \left|H\left(e^{jw}\right)\right| \le 1 \quad 0 \le w \le \frac{\pi}{2}$$

$$\left|H\left(e^{jw}\right)\right| \le 0.2 \quad \frac{3\pi}{4} \le w \le \pi$$

With T=1 second using impulse invariance. [10]

OR

7. Design a Butterworth analog high pass filter that will meet the following specifications

a) Maximum pass band attenuation = 2dB
b) Passband edge frequency = 200rad/sec
c) Minimum stopband attenuation=20dB
d) Stop band edge frequency = 100 rad/sec. [10]

8.a) Given the desired frequency response:

$$H_d(w) = \begin{cases} e^{-j3w}, & -\frac{3\pi}{4} < w < \frac{3\pi}{4} \\ 0, & \frac{3\pi}{4} < |w| < \pi \end{cases}$$

. Find H(w) for N=7. Using a Hanning window.

b) What is an FIR filter? Explain the characteristics of FIR filter. [7+3]

OR

9.a) Determine the frequency response for the symmetric Hanning window given by

$$w_{Han}(n) = \begin{cases} \frac{1}{2}\left[1 + \cos\frac{\pi n}{M}\right], & -M \le n \le M \\ 0, & otherwise \end{cases}$$

Also find W(ω) when M=1.

b) Enumerate the differences between IIR and FIR filters. [7+3]

10.a) Explain coefficient quantization of IIR filters.

b) Explain the polyphase structure of decimator and interpolator. [5+5]

OR

11.a) Discuss in detail the errors resulting from rounding and truncation.

b) Explain the limit cycle oscillations due to product round-off and overflow errors. [5+5]

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