**B.TECH/ECE/6TH SEM/ ECEN 3202/2019**

**DIGITAL SIGNAL PROCESSING & APPLICATIONS**

**(ECEN 3202)**

**Time Allotted : 3 hrs Full Marks : 70**

***Figures out of the right margin indicate full marks.***

***Candidates are required to answer Group A and***

***any 5 (five) from Group B to E, taking at least one from each group.***

***Candidates are required to give answer in their own words as far as practicable.***

**Group – A**

**(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**

1. The period of the signal x(n) = cos( π/2 n) cos(π/4 n) is
2. 8 (b) 4 (c) 32 (d) 12.
3. The ROC of a finite duration discrete time signal is as follows

 (a) Entire z-plane except at z=0 (b) Entire z-plane except at z=∞

 (c) Entire z-plane (d) A ring in the z-plane.

(iii) The N point DFT of finite length signal x(n) = δ (n) is

 (a) 0 (b) WN (c) z-1 (d) 1.

 (iv) Direct evaluation of N point DFT require

(a) N2 multiplication and N2 addition

(b) N multiplication and N addition

(c) N(N-1) multiplication and N2 addition

(d) N2 multiplication and N(N-1) addition.

(v) The convolution of u(n) and u(n-4) at n=5 is

 (a) 2 (b) 1 (c) 5 (d) 0.

(vi) In the bilinear transformation method, the relationship between the analog frequency, Ω and digital frequency, ω is given by

 

 .

(vii) The poles of a Butterworth filter lie on a/an

 (a) circle (b) parabola (c) ellipse (d) helix.

 (viii) FIR filter is always stable because all of its poles are \_\_\_\_\_\_\_\_\_\_\_

(a) at the origin (b) at the infinity

(c) at the ROC (d) none of these.

(ix) A baseband signal has a spectral range that extends from 20 Hz to 82 KHz. The acceptable range of the sampling frequency is

(a) >40 Hz,<82 KHz (b) 40 Hz to 82 KHz

(c) ≥164 KHz (d) ≤164 KHz.

(x) For a rectangular window of N sample , width of main lobe is

 (a) 2π/N (b) 4 π/N (c) 3 π/N (d) π/N.

**Group – B**

2. (a) Determine the pole zero plot for the system described by difference equation y(n) – ¾ y(n-1) + 1/8 y(n-2) = x(n) – x(n-1).

Check the system whether it is stable or unstable for |z| >1/2.

1. Let y(n) denote the convolution of h(n) and g(n), where, h(n) = (1/2)n u(n) and g(n) is causal sequence . If y(0) = 1 and y(1) =1/2 then find the value of g(1).
2. Determine the following system is time variant or time invariant.

 y(n) = x(-n)

 **5+ 5 + 2 =12**

3. (a) An LTI system is characterized by the system function

 

Determine h(n) if the ROC is:

  

 (b) Determine the zero-input response and zero-state response of the system characterized by the difference equation 

 **6 + 6 = 12**

**Group – C**

4. (a) Perform the circular convolution of the following two sequences using graphical method

 $\begin{matrix}x1(n)=\{1,2,2,3,4,\}\\ \uparrow \end{matrix}$ $\begin{matrix}x2(n)=\{2,3,1,1,2\}\\ \uparrow \end{matrix}.$

 (b) A length-8 sequence is given by $\begin{matrix}x(n)=\{-4, 5, 2,-3,0,-2, 3, 4\}\\\uparrow \end{matrix},$ 0≤n≤7, with

 an 8-point DFT given by X(k). Determine the sequence y(n) whose 8-point DFT is given by $y\left(k\right)=e-\frac{j2π3k}{4} x\left(k\right).$

 (c) What do you mean by zero-padding?

 **6 + 5 + 1= 12**

5. (a) Determine the N point IDFT of X(k) = δ(k) 0 ≤ k ≤ N-1 and hence for 0 ≤ k0 ≤ N-1 , determine the DFT of x1(n) = cos(2 π k0 n/N).

(b) Find the 8 point DFT of sequence x(n) = {1,1,1,1,0,0,0,0} using radix 2 DIF-FFT algorithm.

 **4 + 8 =12**

**Group – D**

6. (a) Compare between IIR digital filter and FIR digital filter.

(b) A digital Butterworth filter has to be designed using bilinear transformation. The filter specifications are as follows:

  0≤w≤0.2π

  0.6π≤w≤π

Find the filter order N and cut-off frequency.

(c) Explain the necessity of windowing method in FIR filters.

(d) State the disadvantage of impulse invariant technique.

**3 + 4 +3 +2 = 12**

7. (a) Evaluate the order and the poles of a Butterworth filter which has 2dB attenuation at 1000Hz and 15dB attenuation at 2000Hz. Determine the system function H(z) by bilinear transformation using .

(b) Obtain the digital filter transfer function H(z) from its analog counterpart with transfer function Ha(s) using impulse-invariant method.

**8 + 4 = 12**

**Group – E**

8. (a) Obtain the Direct Form-I and Direct Form-II realization for a third order IIR transfer function which is expressed as below:

 

(b) Determine a cascade realization of the system characterized by the transfer function which is expressed as under:

 

 **(4 + 4) + 4= 12**

9. Write short notes on any two of following.

1. Fourier series method for FIR filter.
2. Design of Butterworth filter.
3. Application of Multi-rate Digital Signal Processing.
4. Architecture of TMS 320C5416.

 **(6 × 2) =12**