CBCS SCHEME

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15MT73

Seventh Semester B.E. Degree Examination, July/August 2021
Signal Process

Time: 3 hrs. Max. Marks: 80

Note: ***Answer any FIVE full questions.***

1 a. Define a signal. State and explain classification of signals along with relevant equations for the same. **(08 Marks)**

b. State and explain the following with relevant equations and sketches :
i) Unit step function (discrete and continuous time)
ii) Unit impulse function (Discrete and continuous time)
iii) Ramp function (discrete and continuous time)
iv) Exponential signals. **(08 Marks)**

2 a. For the signal x(t) shown in below sketch Fig.Q2(a) :
i) $x(-t)$ ii) $x(t+3)$ iii) $x(2t-2)$ iv) $x[0.5(t-2)]$.

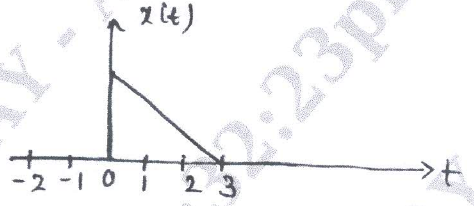

Fig.Q2(a) **(08 Marks)**

b. For the discrete system given below check whether these systems are static or dynamic, linear or non linear, causal or non causal and stable or unstable. Given $y(n) = x(2n)$. **(08 Marks)**

3 a. State and prove commutative and distribution property of convolution sum. **(08 Marks)**

b. Derive an expression for convolution sum. **(08 Marks)**

4 a. Compute the convolution of two sequences $x_1(n)$ and $x_2(n)$ given $x_1(n) = [1, 2, 3]$ and $x_2(n) = [1, 2, 3, 4]$. **(08 Marks)**

b. Evaluate $y(n) = x(n) * h(n)$ where $x(n) = \alpha^n u(n)$ and $h(n) = u(n)$, $0 < \alpha < 1$. **(08 Marks)**

5 a. State and prove : i) Parsevals theorem ii) Linearity property. **(08 Marks)**

b. Find the N-point DFT of the sequence $x(n) = e^{j\omega m n}$ $0 \le x \le N-1$. **(08 Marks)**

6 a. Find the 8 – point DFT of a real sequence x(n) = [1, 2, 2, 2, 1, 0, 0, 0] using DIF – FFT algorithm. **(08 Marks)**

b. Develop the radix 2 – DIF – FFT algorithm for N = 8. Draw the signal flow graph. **(08 Marks)**

7 a. Compare Butterworth and Chebyshev filters. (08 Marks)

b. A Butterworth lowpass filter has to meet the below specifications :

i) Passband gain, k_p = - 1dB at $\Omega_p = 4$rad/sec

ii) Stopband attenuation greater than or equal to 20dB at Ω_S = 8rad/sec

Determine the transfer function $H_a(s)$ of the lowest order Butterworth filter to meet above specifications. (08 Marks)

8 a. Derive an expression for order of a Butterworth filter. (08 Marks)

b. Transform the analog filter $H_a(s) = \dfrac{s+1}{s^2+5s+6}$ into H(z) using impulse invariant transformation. Take T = 0.1sec. (08 Marks)

9 a. Realize the linear phase FIR filter with the below impulse response $h(n) = \delta(n) + \frac{1}{2}\delta(n-1) - \frac{1}{4}\delta(n-2) + \delta(n-4) + \frac{1}{2}\delta(n-3)$. (08 Marks)

b. Realize the following system in cascaded form given :

$H(z) = 1 + \frac{3}{4}z^{-1} + \frac{17}{8}z^{-2} + \frac{3}{4}z^{-3} + z^{-4}$. (08 Marks)

10 a. A difference equation describing a filter is given below :

$y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n) + \frac{1}{2}x(n-1)$

Draw direct form I and direct II form structures. (08 Marks)

b. Design an ideal bandpass filter with frequency response,

$H_d(e^{j\omega}) = 1, \text{ for } \frac{\pi}{4} \le |\omega| \le \frac{3\pi}{4}$

Use rectangular widow with N = 11 in your design. (08 Marks)

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