CBCS SCHEME

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17MT73

Seventh Semester B.E. Degree Examination, June/July 2023
Signal Processing

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Determine whether the following CT signals are periodic or not? If periodic determine the fundamental period. i) $\text{Cost} + \text{Sin}\sqrt{2}t$ ii) $2\text{Cos}100\pi t + 5\text{Sin}50t$ iii) $\text{Cos}100\pi t + \text{Sin}50\pi t$ iv) $2\text{Cost} + 3\text{Cos}\frac{t}{3}$ v) $\text{Cos}^2(2\pi t)$. **(10 Marks)**

b. State and explain time delay, time advancing, time folding and time scaling operations on signals with relevant sketches. **(10 Marks)**

OR

2 a. Find the even and odd components of the signal shown in given below Fig.Q.2(a). **(10 Marks)**

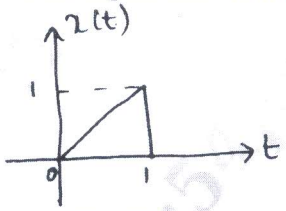

Fig.Q.2(a)

b. Determine whether the following continuous time system is static or dynamic, linear or non linear, causal or non casual, stable or unstable given $y(t) = 10x(t) + 5$. **(10 Marks)**

Module-2

3 a. For the given signal $x(n) = \{0, 1, 5, 6\}$ $h(n) = \{2, 2, 2\}$ find output y(n) using convolution sum formula method. **(10 Marks)**

b. Find y(t) for given signal $x(t) = u(t + 1)$ and $h(t) = u(t - 2)$. **(10 Marks)**

OR

4 a. Find y(t) for given signal
$x(t) = u(t - 2) - u(t - 4)$
$h(t) = u(t + 1) - 2u(t - 1) + u(t - 3)$ **(10 Marks)**

b. For the following s/m y(t), determine whether s/m is linear, Time Invariant, memory less, causal, stable.
$y(t) = e^{x(t)}$ **(10 Marks)**

Module-3

5 a. Compute the 8 point DFT of the sequence x(n) given below
$x(n) = [1, 1, 1, 1, 0, 0, 0, 0]$ **(10 Marks)**

b. State and prove i) Circular time shift property and ii) Circular frequency shift property of DFT. **(10 Marks)**

OR

6 a. Find the 8 point DFT of a sequence x(n) = [1, 1, 1, 1, 0, 0, 0, 0] using DIT-FFT radix 2 algorithm and use the butterfly diagram representation. **(10 Marks)**

b. Compute the 4 point DFT of the sequence x(n) = [1, 2, 1, 0] using regular method and matrix method and verify the result. **(10 Marks)**

Module-4

7 a. Derive an expression for order and cut off frequency of Butterworth filter. **(12 Marks)**

b. For the given specification, pass band ripple ≤ 2db, stop band attenuation ≥ 20db pass band edge is 1 rad/sec. Stop band edge is 1.3 rad/sec. Find the order N and ϵ. **(08 Marks)**

OR

8 a. Design the Chebyshev filter with following specification $A_p = 2.5dB$, $\Omega_p = 20$ rad/sec, $A_s = 30dB$, $\Omega_s = 50$ rad/sec. **(14 Marks)**

b. List out the difference between Butterworth filter and Chebyshev filer. **(06 Marks)**

Module-5

9 a. Design a FIR filter with

$$H_d(e^{jw}) = \begin{cases} e^{-j3w} & \text{for } |w| \le \frac{\pi}{4} \\ 0 & \text{elsewhere} \end{cases}.$$ Using Hamming window with N = 7. **(10 Marks)**

b. The desired frequency response of the low pass filter is given by

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

Determine the frequency response of the FIR filter. If the Hamming window is used with N = 7. **(10 Marks)**

OR

10 a. Realize a Linear phase FIR filter having impulse response

$$h(n) = \delta(n) + \frac{1}{4}\delta(n-1) - \frac{1}{8}\delta(n-2) + \frac{1}{4}\delta(n-3) + \delta(n-4).$$ **(04 Marks)**

b. Obtain the direct form – I and direct form – II realization for a digital filter described by the system function

$$H(z) = \frac{8z^3 - 4z^2 + 11z - 2}{(z - \frac{1}{4})(z^2 - z + \frac{1}{2})}.$$ **(06 Marks)**

c. A FIR filter is given by

$$y(n) = x(n) + \frac{2}{5}x(n-1) + \frac{3}{4}x(n-2) + \frac{1}{3}x(n-3).$$ Draw the Lattice structure. **(10 Marks)**

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