CBCS SCHEME

USN | | | | | | | | | | |

17MT73

Seventh Semester B.E. Degree Examination, Feb./Mar. 2022
Signal Process

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define Signal and System. Give classification of Signals with an example. **(08 Marks)**

b. Sketch the following signals and determine their even and odd components :
i) $x(t) = r(t+2) - r(t+1) - r(t-2) + r(t-3)$ ii) $r(n) = u(n+2) - 3u(n-1) + 2u(n-5)$. **(12 Marks)**

OR

2 a. Determine whether the following signals are energy or power signals and calculate the same
i) $x(n) = (\frac{1}{2})^n u(n)$ ii) $x(t) = Ae^{-\alpha t} u(t)\ \alpha > 0$. **(06 Marks)**

b. Given the signal x(t), sketch the following : i) $x(-2t+3)$ ii) $x(\frac{t}{2}-2)$.
[Refer Fig.Q2(b)] **(04 Marks)**

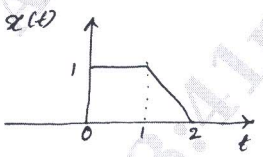

Fig.Q2(b)

c. Determine whether the following systems are
i) Static or Dynamic ii) Linear or Non linear iii) Time variant of Invariant
iv) Causal or Non Casual v) Stable or Unstable with explanation.
i) $\frac{d}{dt} y(t) + t\, y(t) = x(t)$ ii) $y(n) = x(n) + n\, x(n+1)$. **(10 Marks)**

Module-2

3 a. Derive the formula for Convolution Integral. **(08 Marks)**

b. Obtain the convolution of two functions given below :
$x(t) = \begin{matrix} 2 & \text{for } -2 \le t \le 2 \\ 0 & \text{elsewhere} \end{matrix}$; $h(t) = \begin{matrix} 4 & \text{for } 0 \le t \le 2 \\ 0 & \text{elsewhere} \end{matrix}$. **(12 Marks)**

OR

4 a. Determine the convolution sum of the two sequences
$x(n) = \{\underset{\uparrow}{3}, 2, 1, 2\}$ and $h(n) = \{1, \underset{\uparrow}{2}, 1, 2\}$. **(04 Marks)**

b. State and prove the Commutative property , Cascade and Parallel connection of impulse response representation for LTI systems. **(06 Marks)**

c. Determine the Unit sample response of below system in Fig.Q4(c) : **(10 Marks)**

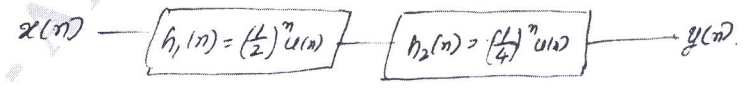

Fig.Q4(c)

Module-3

5 a. Evaluate the Circular Convolution of $x_1(n)$ and $x_2(n)$ using DFT and LDFT.

$x_1(n) = (\frac{1}{2})^n \quad 0 \le n \le 3 \qquad ; \quad x_2(n) = 1 \quad 0 \le n \le 3.$ **(10 Marks)**

b. Determine the response of an LTI system with $h(n) = \{1, -1, 2\}$ for an input $x(n) = \{1, 0, 1, -2, 1, 2, 3, -1, 0, 2\}$. Employ overlap add method with block length L = 4. **(10 Marks)**

OR

6 a. Derive the radix – 2 FFT – DIT algorithm and draw the signal flow graph for N = 8. **(10 Marks)**

b. Compute 8 - point DFT of the sequence x(n). Using DIF – FFT algorithm

$x(n) = \sin(\frac{\pi}{2}n) \quad 0 \le n \le 7.$ **(10 Marks)**

Module-4

7 a. An analog Chebyshev low pass filter with pass band attenuation of 2.5 dB at 200Hz , Stop band attenuation of 30dB at 500Hz is required. Obtain the transfer function H(s). **(10 Marks)**

b. Let $H(s) = \frac{1}{s^2 + \sqrt{2}\,s + 1}$ transfer function of the system whose passband frequency is 1 rad/sec. Using frequency transformation compute system functions for

i) A low pass filter with passband of 10rad/sec.
ii) A high pass filter with passband of 10rad/sec.
iii) A band pass filter with passband 10rad/sec and center frequency of 100rad/sec. **(10 Marks)**

OR

8 a. Design a Butterworth filter using the Bilinear transformation for the following specifications

$0.8 \le (H(e^{jw}) \le 1 \quad \text{for} \quad 0 \le w \le 0.2\pi$
$(H(e^{jw}) \le 0.2 \quad \text{for} \quad 0.6\pi \le w \le \pi$ **(10 Marks)**

b. The system function of the analog filter is given as

$H(s) = \frac{s + 0.1}{(s + 0.1)^2 + 9}$. Obtain the system function of the IIR digital filters by using Impulse Invariance method. **(10 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 Lattic structure. **(10 Marks)**

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