CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐

15MT73

Seventh Semester B.E. Degree Examination, Aug./Sept.2020

Signal Process

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define Signal. List the types of signals with an example for each. **(08 Marks)**

b. Evaluate even and odd component of the signal (i) $x_1(t) = \cos t + \sin t + \sin t . \cos t$ (ii) $x_2(t)$, is given in Fig.Q1(b). **(08 Marks)**

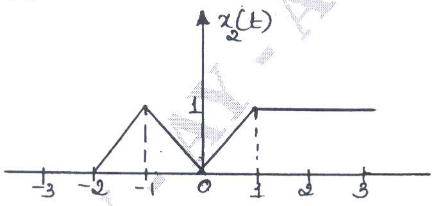

Fig.Q1(b)

OR

2 a. Check whether the given signal is periodic or not? If periodic find the fundamental period $x(t) = \cos(t + \pi/4)$. **(04 Marks)**

b. For the signal $x(n) = \{\underset{\uparrow}{0.5}, 1 , 2 , 4 , 8 \}$

c. Sketch $y_1(n) = x(n - 3)$ and $y_2(n) = x(-n + 4)$ **(04 Marks)**

Two signal x(t) and g(t) are shown in Fig.Q2(c). Express the signal x(t) in terms of g(t).

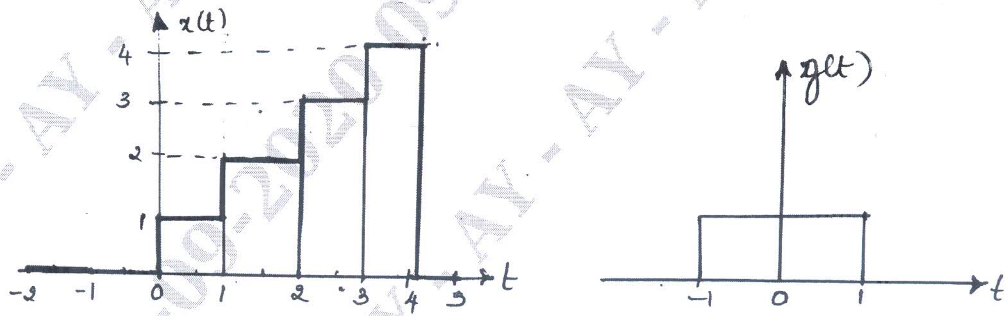

Fig.Q2(c) **(08 Marks)**

Module-2

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

b. Determine the convolution of $x_1(n) = \{ \underset{\Uparrow}{1} , 2 , 3 \}$ and $x_2(n) = \{ 1 , 2 , \underset{\Uparrow}{3} , 4)$ **(08 Marks)**

OR

4 a. State and prove commutative and distributive property for convolution integral. **(08 Marks)**

b. Evaluate the convolution of $x_1(t) = e^{-2t} u(t)$ and $x_2(t) = u(t + 2)$ **(08 Marks)**

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-3

5 a. Find the 4-point discrete fourier transform of $x(n) = \{ \underset{\uparrow}{1}, 2, 3, 1 \}$. **(04 Marks)**

b. A long sequence x(n) is filtered through a filter with a impulse response h(n) to yield the output y(n). If $x(n) = \{\underset{\uparrow}{1}, 2, 3, 3, 2, 1, -1, -2, -3, 5, 6, -1, 5, 0, 2, 1\}$ and $h(n) = \{1, \underset{\uparrow}{2}\}$

Compute y(n) using overlap add technique assuming block length as 7. **(12 Marks)**

OR

6 a. Compute the N-point DFT of $x(n) = a^n$ for $0 \le n \le N-1$. **(04 Marks)**

b. Find the 8-point DFT of the sequence $x(n) = \{ \underset{\uparrow}{1}, 1, 1, 1, 0, 0, 0, 0 \}$ using DIT-FFT radix-2 algorithm. Draw the signal flow graph. **(12 Marks)**

Module-4

7 a. Let $H(s) = \dfrac{1}{s^2 + s + 1}$ represent the transfer function of a lowpass filter with a passband of 1 rad/sec. Use frequency transformation to find the transfer function of the following analog filters.

(i) A lowpass filter with a passband of 10 rad/sec.

(ii) A high pass filter with a cutoff frequency of 1 rad/sec. **(08 Marks)**

b. Derive an expression for the order of Butterworth low pass filter. **(08 Marks)**

OR

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

b. Compare Butterworth and Chebyshev filters. **(08 Marks)**

Module-5

9 a. A lowpass filter is to be designed with the following desired frequency response.

$$H_d(e^{jw}) = H_d(w) = \begin{cases} e^{-j2w} & |w| < \pi/4 \\ 0, & \pi/4 < |w| < \pi \end{cases}$$

Determine the filter coefficients $h_d(n)$ $h(n)$ if $w(n)$ is a rectangular window defined as

$$W_R(n) = \begin{cases} 1, & 0 \le n \le 4 \\ 0, & \text{otherwise} \end{cases}$$ **(10 Marks)**

b. Draw the block diagram of direct form-I and direct form-II for system function

$$H(z) = \frac{8 - 4z^{-1} + 11z^{-2} - 2z^{-3}}{1 - \frac{5}{4}z^{-1} + \frac{3}{4}z^{-2} - \frac{1}{8}z^{-3}}$$ **(06 Marks)**

OR

10 a. Compare IIR filter and FIR filters. **(08 Marks)**

b. Obtain a cascade realization for a system described by

$$H(z) = \frac{1 + \frac{1}{4}z^{-1}}{\left(1 + \frac{1}{2}z^{-1}\right) + \left(1 + \frac{1}{2}z^{-1} + \frac{1}{4}z^{-2}\right)}$$ **(08 Marks)**

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