CBCS SCHEME

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17EE54

Fifth Semester B.E. Degree Examination, Jan./Feb. 2023
Signals and Systems

Time: 3 hrs. Max. Marks: 100

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

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-1

1 a. Distinguish between :
i) Continuous and discrete time signals
ii) Even and odd signals
iii) Periodic and non-periodic signals
iv) Power and energy signals. **(08 Marks)**

b. Find the even and odd components of the signal $x(t) - e^{-2t}\cos t$. **(04 Marks)**

c. A triangular pulse signal x(t) is depicted in Fig.Q1(c). Sketch each of the following signals derived from x(t).
i) $x(3t)$
ii) $x(3t+2)$
iii) $x(2(t+2))$
iv) $x(3t) + x(3t+2)$

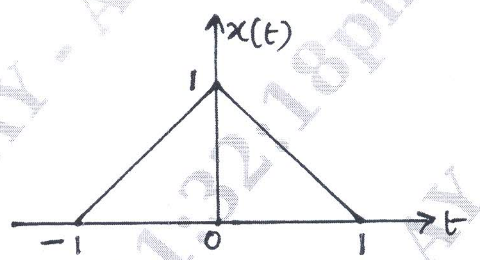

Fig.Q1(c) **(08 Marks)**

OR

2 a. For each of the following signals, determine whether it is periodic, and if it is, find the fundamental period : i) $x(t) = \sin^3(2t)$ ii) $x[n] = [-1]^{n^2}$ iii) $x[n] = \cos[2n]$. **(06 Marks)**

b. Categorize each of the following signals as an energy signal or a power signal and find its corresponding value.

i) $x(t) = \begin{cases} t; & 0 \le t \le 1 \\ 2-t; & 1 \le t \le 2 \\ 0; & \text{otherwise} \end{cases}$

ii) $x(n) = \begin{cases} n; & 0 \le n \le 5 \\ 10-n; & 5 \le n \le 10 \\ 0; & \text{otherwise} \end{cases}$ **(06 Marks)**

c. Check whether the following system is :
i) Static or dynamic
ii) Linear or non – linear
iii) Causal or non-causal
iv) Time invariant or time variant
Justify the answer. $y[n] = \log_{10}|x[n]|$. **(08 Marks)**

Module-2

3 a. Find the convolution sum of the sequences :

$x[n] = \{\underset{\uparrow}{3}, 4, 1, 2\}$ and $h[n] = \{\underset{\uparrow}{1}, 1, 2, 3\}$

using graphical method. **(08 Marks)**

b. For the following impulse responses, determine whether the corresponding system is memoryless ; causal and stable. Justify the answer :

i) $h(t) = e^{at}u(t); a < 0$

ii) $h[n] = \left[\frac{1}{2}\right]^n u[n]$. **(06 Marks)**

c. Draw direct form I and direct form II implementations of the system described by the difference equation : $y[n] + \frac{1}{4}y[n-1] + \frac{1}{8}y[n-2] = x[n] + x[n-1]$. **(06 Marks)**

OR

4 a. Evaluate the convolution integral for a system with input x(t) and impulse response h(t), given by :

$x(t) = \begin{cases} 1, & 0 < t < 2 \\ 0, & \text{otherwise} \end{cases}$ $h(t) = e^{-t}u(t)$. **(08 Marks)**

b. Find the step response of the first – order recursive system with impulse response. $h[n] = \alpha^n u[n]$, assuming that $|\alpha| < 1$. **(04 Marks)**

c. Find the complete solution for the first–order recursive system described by difference equation : $y[n] - \frac{1}{4}y[n-1] = x[n]$, if input $x[n] = \left[\frac{1}{2}\right]^n u(n)$ and the initial condition is $y[-1] = 8$. **(08 Marks)**

Module-3

5 a. Find the Fourier transform of the following signals :

i) $x(t) = e^{2t}u(-t)$

ii) $x(t) = e^{-|t|}$. **(06 Marks)**

b. State and prove convolution property of continuous time Fourier transform. **(08 Marks)**

c. Find the Fourier transform of the system output, for the following input and impulse response : $x(t) = 3e^{-t}u(t)$ and $h(t) = 2e^{-2t}u(t)$. **(06 Marks)**

OR

6 a. Prove differentiation in time property of CTFT. **(06 Marks)**

b. Determine the time-domain signal corresponding to the following Fourier transform.

$$X(j\omega) = \frac{-j\omega}{(j\omega)^2 + 3j\omega + 2}.$$ **(08 Marks)**

c. Find the frequency response of LTI system described the differential equation :

$$\frac{d^3y(t)}{dt^3} + \frac{6d^2y(t)}{dt^2} + \frac{5dy(t)}{dt} + 4y(t) = 3x(t).$$ **(06 Marks)**