Total No. of Questions : 10]

SEAT No. :

PF-12719

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S.E. (E&TC/Electronics/EE-VLSI D&T/ECE-ACT)

PCC-252-ETC : SIGNALS AND SYSTEMS

(2024 Pattern) (Semester - IV)

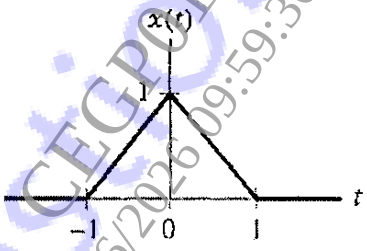
Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary.***
5) ***Use of electronic pocket calculator is allowed.***

Q1) a) A triangular pulse signal $x(t)$ is shown in Fig. Sketch each of the following signals derived from $x(t)$. **[6]**

i) $x(3t)$ ii) $x(3t+2)$ iii) $2x(t-3)$



b) Determine whether the following signals are periodic or non- periodic. If they are periodic find fundamental period. **[6]**

i) $x[n] = (-1)^n$

ii) $x[t] = \cos(2t) + \sin(3t)$

c) State mathematically sifting (sampling) property and time scaling property of CT impulse function. **[2]**

OR

Q2) a) Find if the following signals are energy signals or power signals or neither and find the value of the same. **[6]**

i) $x(t) = tu(t)$

ii) $x(t) = 5\cos(\pi t) + \sin(5\pi t)\ -\infty < t < \infty$

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b) Sketch even and odd parts of following signals. **[6]**

i) u(t)

ii) x[n] = {1, 1, 1, 1, 1}

c) Draw the following signals **[2]**

i) CT Double (Both) sided exponential

ii) CT Gaussian function

Q3) a) For system represented in I/O form below, find if it is static, causal and invertible. **[6]**

$y(t) = x(3 - t)$

b) Obtain Direct form I realization of LTI system governed by the equation **[6]**

$$y[n] = \frac{-1}{8}y[n-1] + \frac{5}{32}y[n-2] + \frac{1}{64}y[n-3] + x[n] + 3x[n-1] + 2x[n-2]$$

c) State any two properties of FIR systems. **[2]**

OR

Q4) a) Draw Direct form structure of FIR system described by transfer function **[6]**

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

b) For system represented in I/O form below, find if it is linear, time invariant, and stable **[6]**

y[n] = logx[n]

c) State any two properties of IIR systems. **[2]**

Q5) a) Obtain Convolution integral graphically for given LTI system with input x(t) and impulse response h(t) given as x(t) = u(t+1), h(t) = u(t – 3) . Also sketch the output of LTI system. **[6]**

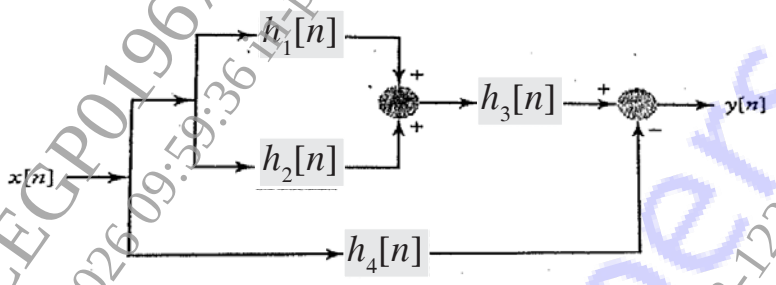
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b) Consider the interconnection of LTI system shown in Fig. The impulse response of each system is given by, **[6]**

$h_1[n] = u[n]$ $h_2[n] = u\{n + 2] - u[n]$

$h_3[n] = \delta[n - 2]$ $h_4[n] = \alpha^n u[n]$

Find the impulse response of the overall system, $h[n]$



c) State and explain properties of convolution integral. **[2]**

OR

Q6) a) Obtain convolution sum graphically for the following two sequences. Also sketch the output. **[6]**

x[n] = {3, 2, 1, 4}, h[n] = {5, 6}
↑

b) For the given LTI system represented in terms of impulse response, determine whether the system is memoryless, causal and stable **[6]**

$h(t) = e^{2t}u(t - 3)$

c) For the given LTI system find step response if **[2]**

$h[n] = \delta[n] - \delta[n - 2]$

Q7) a) Find Continuous Time Fourier Transform (CTFT) of the signal $x(t) = e^{-2t}u(t)$. Also plot amplitude and phase spectrum. **[8]**

b) Find exponential Fourier series for the periodic train of unit impulse given by $x(t)=\sum_{k=-\infty}^{\infty}\delta(t-kT_0)$. Also plot amplitude and phase spectrum. **[6]**

OR

Q8) a) Explain Gibb's Phenomenon with relevant diagrams showing effect of increased harmonic frequencies to reconstruct original signal. **[5]**

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b) Find CTFT of the following signals : **[6]**

i) $x(t) = e^{7t}u(-t)$

ii) $x(t) = \text{sgn}(t)$

c) Using duality property find CTFT of signal x(t) = sinc(t) **[3]**

Q9) a) Find Laplace Transform of the following signal. Also find and sketch ROC **[5]**

$x(t) = e^{-3t}u(t) + e^{2t}u(-t)$

b) If Laplace Transform $X(s)=\frac{2s}{s^2+9}$, find **[5]**

i) $x(t)$

ii) $x(t) * u(t)$

iii) $x(2t)$

c) Find initial and Final value for the given Laplace Transform

$$X(s)=\frac{7s+20}{s(s+4)}$$ **[4]**

OR

Q10)a) Find Inverse Laplace Transform for the given ROC cases if

$X(s)=\frac{3s+7}{s^2-4s+3}$ for **[6]**

i) Rs(s) < 1

ii) 1 < Rs(s) < 3

b) Find the transfer function and impulse response of the system governed by following differential equation **[6]**

$$\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 6y(t) = x(t) + \frac{d}{dt}x(t)$$

c) Compare Fourier Transform and Laplace Transform **[2]**