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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING,
ANNA UNIVERSITY, CHENNAI

B.E / B. Tech (Full Time) END SEMESTER EXAMINATIONS – APR/MAY 2024

EE 5301 Signals and Systems (Regulation 2019)

Time: 3 Hr. Answer ALL Questions Max. Marks 100

COURSE OUTCOMES:

CO1: To introduce the fundamentals and classifications of signals.

CO2: To get familiarized to system representation and stability study with Laplace Transform.

CO3: To analyze the continuous-time signals, Fourier series and to learn to apply frequency analysis.

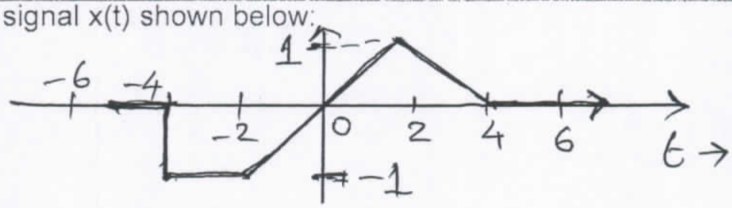
CO4: To impart knowledge on discrete time signals and discretized systems.

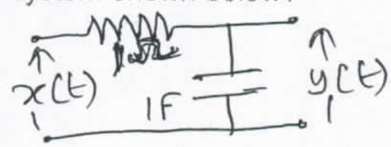
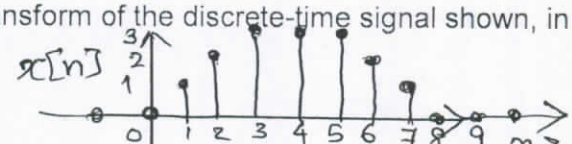
CO5: To understand importance of sampling theorem and its implications.

PART- A (10 x 2 = 20 Marks)

Q.No	Questions	Marks	CO	
1.	Plot the typical impulse response for the below cases: • Real pole on the left half of s-plane • Complex conjugate pole pair on the imaginary axis.	2	CO2	
2.	Find the fundamental period of the given periodic signal: $x(t) = 0.6\cos(5t + \pi/3) + 0.7\sin(7t + \pi/4)$.	2	CO1	
3.	Give pictorial representation for the following signals: unit impulse and unit-step function. How are these two signals related?	2	CO1	
4.	What is meant by 'spectral energy'?	2	CO5	
5.	Distinguish between 'Zero Order Hold' and 'First order Hold'?	2	CO5	
6.	Give the definition of Z-transform of a sequence x[n]? What is the Z-transform of the unit-impulse signal?	2	CO4	
7.	What are the Fourier series components of $f(x) = \sin^2 x$?	2	CO3	
8.	Find the Fourier Transform of $x(t) = 4\,\delta(t)$, where $\delta(t)$ is unit impulse.	2	CO2	
9.	Given x[n] = u[n] – u[n-3], what is its Z-transform and ROC?	2	CO4	
10.	State the Dirichlet's conditions?	2	CO3	

PART- B (5 x 13 = 65 Marks)

Q.No	Questions	Marks	CO	
11.	a) Consider the signal x(t) shown below:  i) express this signal x(t) in terms of step and ramp functions, ii) Also, plot x(t-1) + x(-t+3).	13	CO1	
	OR			
	b) Determine whether the given systems are linear or non-linear. Also find whether they are time-varying or invariant? * $d^2y(t)/dt^2 + 7\,dy(t)/dt + 12\,y(t) = x(t)$ * $y[n] = 4\,x[n]\,x[n-3]$	13	CO1	

12.	a) i)What is the step-response of the system shown below?  Also find the output of the system, when the input applied is $e^{-4t}u(t)$. ii) Perform convolution of [1 2 2 1] and [1 2 2 1]. (8 + 5)	13	CO2
	OR		
	b) i) Given the differential equation characterizing a continuous-time system: $d^2y(t)/dx^2 + 3\, dy(t)/dx + 2\, y(t) = x(t)$, find the transfer function Y(s)/X(s) ? ii) Given the initial conditions for this system as y(0-) = 0 and dy(0-)/dx = 1, find the impulse response? (7 + 6)	13	CO2
13.	a) Obtain the Fourier series expansion of the periodic signal x(t) = t for $-T/4 < t < T/4$ and $x(t) = \{T/2 - \|t\|\}$ for $T/2 > \|t\| > T/4$. Does the given signal possess odd or even symmetry? Comment.	13	CO3
	OR		
	b) Given the signal $x(t) = e^{-2\|t\|}$, plot the magnitude and phase spectra. Here, |t| refers to the magnitude of 't' , i.e, equals –t, if t<0.	13	CO[illegible]
14.	a) Derive the transfer function of the ZOH (Zero Order Hold) and explain the signal reconstruction technique?	13	CO5
	OR		
	b) What is 'aliasing effect'? How is it avoided by selecting the sampling rate above the Nyquist rate? Comment on the bandwidth and cut-off frequency requirements for the reconstruction filter.	13	CO5
15.	a) i) Determine the causal signal x[n] having the Z-transform : $X(z) = \dfrac{(z^2+2z+1)}{4\,(3z^2-7z+2)}$ ii) Find the Z-transform of the discrete-time signal shown, in closed-form:  (7 + 6)	13	CO4
	OR		
	b) i) Determine the impulse response of the system described by the difference equation: y[n]-3y[n-1]-4y[n-2]=x[n]+2x[n-1], using Z-transform. ii) Consider the sequence defined by x[n] = x[n-1] + x[n-2], with the initial conditions: x[0]=x[1]=1. Find x[5]. (10 + 3)	13	CO4

PART- C (1 x 15 = 15 Marks)

(Q. No 16 is Compulsory)

Q.No	Question	Marks	CO
16.	Obtain the transfer function, pole zero locations and the state-space model for the system described by the differential equation: $d^3y(t)/dt^3 + 4\, d^2y(t)/dt^2 + 7\, dy(t)/dt + 12\, y(t) = d^2x(t)/dt^2 + 6\, dx(t)/dt + 5\, x(t)$. What can you infer about the stability of the system from the pole-zero locations?	15	CO2