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ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. /B.Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, APR / MAY 2025

ELECTRONICS AND COMMUNICATION ENGINEERING

Semester III

EC23302 & SIGNALS AND SYSTEMS

(Regulation 2023)

Time: 3hrs

Max. Marks: 100

CO1	Classify signals and systems based on various characteristics and decomposition for easier analysis.
CO2	Analyze frequency components of signals and frequency response of LTI systems.
CO3	Analyze the causality and stability LTI systems from their impulse responses
CO4	Convert the CT signals into DT signals and analyze the effect of sampling and frequency content of sampled signals.
CO5	Analyze the processing of random signals with LTI systems.

BL – Bloom's Taxonomy Levels

(L1-Remembering, L2-Understanding, L3-Appling, L4-Analysing, L5-Evaluating, L6-Creating)

PART- A (10x2=20Marks)

(Answer all Questions)

Q.No.	Questions	Marks	CO	BL
1	Find the periodicity of $\cos(0.1\pi n)$.	2	1	3
2	Show the relationship among the impulse signal, step signal, and ramp signal.	2	1	2
3	State the Dirichlet's conditions of Fourier series.	2	2	1
4	Find the Fourier transform of the signal $x(t) = \delta(t)$ also sketch the magnitude and phase spectrum	2	2	2
5	Given the differential equation representation of the system $\frac{d^2y(t)}{dt^2} + 2\frac{dy(t)}{dt} - 3y(t) = 2x(t)$. Find the frequency response.	2	3	1
6	List the properties for convolution integral.	2	3	1
7	State Sampling theorem	2	4	1
8	What is aliasing? And how to overcome aliasing?	2	4	2
9	State Central limit theorem.	2	5	1
10	List the sufficient and necessary conditions for the process to be WSS.	2	5	2

PART- B (5x 13=65Marks)

(Restrict to a maximum of 2 subdivisions)

Q.No.	Questions	Marks	CO	BL
11 (a)	(i). Determine whether the following signal is periodic. If periodic determine the fundamental period. $x(t) = 3\cos(4t) + 2\sin(\pi t)$ (ii). Sketch the following signals $-2u(t-1)$ and $r(-t+2)$ (iii). Estimate the following signal is Energy or Power signal $x(t) = tu(t)$	4 5 4	1	2
OR				

11 (b)	Determine whether the following system is Linear or nonlinear, time variant or time invariant, causal or non-causal and stable or dynamic. $y(n) = x^2(n)$	13	<u>1</u>	<u>2</u>
12 (a)	(i). Determine the Fourier series for the full rectified sinewave. (ii). State any two properties of Fourier series.	7 6	<u>2</u>	<u>3</u>
OR				
12 (b)	Determine the Fourier transform of the signal and plot the Magnitude and Phase Spectrum. $x(t) = e^{-at}u(t), a > 0$	13	<u>2</u>	<u>3</u>
13 (a)	Determine the Convolution of following signals. $x(t) = u(t)$ and $h(t) = u(t)u(t-2)$.	13	<u>3</u>	<u>4</u>
OR				
13 (b)	The LTI system, initially at rest is described by the differential equation $\frac{d^2y(t)}{dt^2} + 3\frac{dy(t)}{dt} + 2y(t) = \frac{dx(t)}{dt} + 3x(t)$. Find the system function and impulse response $h(t)$.	13	<u>3</u>	<u>4</u>
14 (a)	Let the maximum spectral frequency component (f_m) in an analog information signal be 3.3KHz. Can you identify the frequency spectra of sampled signal under the following relationships between the sampled frequency (f_s) and maximum analog signal frequency (f_m) (a) $f_s = 2f_m$ (b) $f_s > 2f_m$ and (c) $f_s < 2f_m$	13	<u>4</u>	<u>4</u>
OR				
14 (b)	Describe Natural Sampling and Flat top Sampling with necessary diagram and expressions.	13	<u>4</u>	<u>1</u>
15 (a)	Derive the expression for Power spectral density and prove its properties.	13	<u>5</u>	<u>1</u>
OR				
15 (b)	Let X have the uniform distribution given by $f_x(x) = \begin{cases} \frac{1}{2\pi}, & 0 \leq \theta \leq 2\pi \\ 0, & \text{elsewhere} \end{cases}$. Solve for mean, mean square value and variance.	13	<u>5</u>	<u>3</u>

PART- C(1x 15=15Marks)
(Q.No.16 is compulsory)

Q.No.	Questions	Marks	CO	BL
16.	(i). Determine the properties such as linearity, causality, time invariance and dynamicity of the given system. $y(n) = x(n)x(n-1)$	5	<u>1</u>	<u>5</u>
	(ii) Find the response $y(t)$ of a continuous time system using Laplace transform with transfer function $H(s) = \frac{1}{(s+2)(s+3)}$ for an input $x(t) = e^{-t}u(t)$.	10	<u>3</u>	<u>5</u>

