

ELECTRONICS & COMMUNICATION ENGINEERING DEPARTMENT
2nd MID SEMESTER (CLASS TEST) EXAMINATION 2024-2025
IEC 403 Signal System, 4th Semester

TIME 1 HOUR

MAX MARKS 20

Instruction: Attempt all the questions.

Q. No.	Question Paper Based On Course Outcomes According To Bloom's Cognitive Level	Marks	CO
1	The Fourier series of the periodic signal $x(t)$ given as $x(t) = \sum_{k=-\infty}^{\infty} a_k e^{jk\omega_0 t}$. Determine the Fourier Transform of $x(t)$	4	CO3
2	Find the Fourier transform of even - odd decomposition of signal $x(n)$.	4	CO2
3	State and prove the Parseval's relationship for continuous time signal $x(t)$	4	CO3
4	Determine the Fourier Transform of of impulse train $p(t) = \sum_{k=-\infty}^{\infty} \delta(t - kN)$	4	CO2
	State and prove the sampling theorem with example as well as aliasing condition.	4	CO4

B.TECH.
(SEM IV) EVEN SEMESTER EXAMINATION 2023-24
SIGNAL SYSTEM

[TIME: 3 hrs.]

Note: Attempt All Questions. All Question carry equal marks.

[Max. Marks: 70]

Q1.

Answer ALL parts.

Consider the system $y(n) = 3x(n) + 4$, is this system Linear and Time Invariant?
 not

Marks
3.5

OR
 Consider the system $y(n) = \text{Im}\{x(n)\}$, is this system Linear and Time Invariant?
 Determine the step response of an LTI system whose impulse response $h(n)$ is given by $h(n) = a^n u(n)$, $0 < a < 1$.

3.5

Find the frequency response of the system $y(n) = \frac{1}{3}y(n-2) + x(n-1)$

3.5

Show that the system is stable if the impulse response is absolutely summable,
 i.e., $\sum_{n=-\infty}^{\infty} |h(n)| < \infty$

3.5

OR

Consider a discrete-time system S_1 with impulse response $h(n) = \left(\frac{1}{5}\right)^n u(n)$,
 Find the integer A such that $h(n) - A\delta(n-1) = \delta(n)$.

Q2. Answer ALL parts.

State and prove the Parseval's relation for continuous time periodic signals.

OR

Determine the Fourier series coefficients c_k of the periodic convolution of two discrete time signals $x_1(n)$ and $x_2(n)$ with same time period N in terms of Fourier series coefficients a_k and b_k of given two discrete time periodic signals $x_1(n)$ and $x_2(n)$ respectively.

Consider a causal LTI system with frequency response $H(j\omega) = \frac{1}{j\omega + 3}$, For a particular input $x(t) = e^{-2t}u(t) - e^{-3t}u(t)$. Determine $x(t)$ to produce the output $y(t) =$

Q3.

Answer ALL parts.

Determine the DTFT of real and imaginary decomposition of signal $x(n)$ in terms of $X(e^{j\omega})$ which is DTFT of $x(n)$.

OR

A continuous-time periodic signal $x(t)$ is real valued and has a fundamental period $T=8$. The nonzero Fourier series coefficients for $x(t)$ are specified as

$a_1 = a_{-1} = r - j$, $a_5 = a_{-5} = 1$, Express $x(t)$ in the form $x(t) = \sum_{k=0}^{\infty} A_k \cos(\omega_k t + \phi_k)$

- (b) Let $x(t)$ be a periodic signal with period T and Fourier coefficients a_k
- Express the Fourier coefficients b_k of $|x(t)|^2$ in terms of a_k
 - If the coefficients a_k are real, is it guaranteed that the coefficients b_k are also real?

7

Q4 Answer ALL parts.

Determine and plot the DTFT of $x(n) = a^{|n|}u(n)$, $|a| < 1$.

7

OR

Determine and plot the DTFT of $x(n) = \begin{cases} 1, & |n| \leq N_1 \\ -1, & |n| > N_1 \end{cases}$, $|a| < 1$,

For illustration $N_1 = 2$,

Determine CTFT for followings, (i) $x(t) = 1$, (ii) $x(t) = \delta(t)$.

Q5 Answer ALL parts.

Explain with diagram the stability and causality of discrete time system through ROC in the z plane by taking suitable example.

7

OR

Write down the properties of ROC for continuous time system in the s plane. What is sampling? Explain with diagram the recovery of analog signal from discrete time signal through LPF.

7

B.Tech.
(SEM IV) END SEMESTER EXAMINATION 2024-25
SIGNAL SYSTEM

[TIME: 3 hrs.]

[Max. Marks: 70]

Note: Attempt All Questions. All Question carry equal marks.

- Q1. Answer ALL parts.**
- | | | |
|------------|--|--------------|
| (a) | Consider the system $y(n) = 3x(n-1) + 4$, is this system Linear and Time Invariant ? | Marks
3.5 |
| OR | | |
| (b) | Consider the system $y(n) = \text{Im}\{x(n)\}$, is this system Linear and Time Invariant ? | 3.5 |
| (c) | Determine the step response of an LTI system whose impulse response $h(n)$ is given by $h(n) = a^n u(n)$, $0 < a < 1$. | 3.5 |
| (d) | Determine the fourier transform of conjugate symmetric and anti-symmetric part of discrete time signal. | 3.5 |
| | Show that the system is stable if the impulse response is absolutely summable, i.e., | 3.5 |

$$\sum_{n=-\infty}^{\infty} |h(n)| < \infty$$

OR

Consider a discrete – time system S_1 with impulse response $h(n) = (\frac{1}{5})^n u(n)$,
Find the integer B such that $h(n) - Bh(n-1) = \delta(n)$.

- Q2. Answer ALL parts.**
- | | | |
|------------|--|---|
| (a) | State and prove the Parseval's relation for discrete time periodic signals | 7 |
| OR | | |

Determine the Fourier series coefficients c_k of the periodic convolution of two discrete time signals $x_1(n)$ and $x_2(n)$ with same time period N in terms of Fourier series coefficients a_k and b_k of given two discrete time periodic signals $x_1(n)$ and $x_2(n)$ respectively.

- | | | |
|------------|---|---|
| (b) | Consider a causal LTI system with frequency response $H(j\omega) = \frac{1}{j\omega + 4}$, For a particular input $x(t)$ this system is observed to produce the output $y(t) = e^{-2t} u(t) - e^{-3t} u(t)$. Determine $x(t)$. | 7 |
|------------|---|---|

- Q3. Answer ALL parts.**
- | | | |
|------------|--|---|
| (a) | Determine the DTFT of real and imaginary decomposition of signal $x(n)$ in terms of $X(e^{j\omega})$ which is DTFT of $x(n)$. | 7 |
|------------|--|---|

OR

A continuous – time periodic signal $x(t)$ is real valued and has a fundamental period $T=8$. The nonzero Fourier series coefficients for $x(t)$ are specified as

$a_1 = a_{-1} = -j$, $a_5 = a_{-5} = 1$, Express $x(t)$ in the form $x(t) = \sum_{k=0}^{\infty} A_k \cos(\omega_k t + \phi_k)$

- (b) Let $x(t)$ be a periodic signal with period T and Fourier coefficients a_k 7
- (i) Express the Fourier coefficients b_k of $|x(t)|^2$ in terms of a_k
- (ii) If the coefficients a_k are real, is it guaranteed that the coefficients b_k are also real?

Q4. Answer ALL parts.

- (a) Determine and plot the DTFT of $x(n) = a^{|n|}u(n)$, $|a| < 1$. 7

OR

Determine and plot the DTFT of $x(n) = \begin{cases} 1, & |n| \leq N_1 \\ -1, & |n| > N_1 \end{cases}$, $|a| < 1$,

For illustration $N_1 = 2$,

Determine CTFT for followings, (i) $x(t) = u(t)$, (ii) $x(t) = \delta(t)$. 7

Q5. Answer ALL parts.

- (a) Explain with diagram the stability and causality of discrete time system through ROC in the z plane by taking suitable example. 7

OR

Write down the properties of ROC for continuous time system in the s plane.

- (b) What is sampling? Explain with diagram the recovery of analog signal from discrete time signal through LPF. 7

CO-BL Mapping

End Semester Examination 2024-25			
Subject Code: IEC-403			
Subject Name: Signal System			
Q.No.	Marks	CO	BL
1(a)	3.5	1	1
1(b)	3.5	1	2
1(c)	3.5	2	3
1(d)	3.5	2	2
2(a)	7	2	4
2(b)	7	3	3
3(a)	7	3	3
3(b)	7	4	3
4(a)	7	4	2
4(b)	7	4	3
5(a)	7	5	5
5(b)	7	5	4