Total No. of Questions: 6 *Total No. of Printed Pages:3*

Enrollment No.....

Faculty of Engineering

End Sem (Odd) Examination Dec-2022

EE3CO27 Signals & Systems

Programme: B.Tech. Branch/Specialisation: EE

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

Q.1 i. Sine wave signal is **1**

(a) An energy signal (b) A power signal

(c) A short-lived signal. (d) Neither energy nor power signal.

ii. A signal is a power signal if **1**

(a) $0 < P < \infty$ (b) $E = \infty$

(c) $0 < P < \infty$ and $E = 0$ (d) $0 < P < \infty$ and $E = \infty$

iii. Which of the following is not Dirichlet's condition for the Fourier series expansion? **1**

(a) f(x) is aperiodic, single valued, finite

(b) f(x) has finite number of discontinuities in only one period

(c) f(x) has finite number of maxima and minima

(d) f(x) is a periodic, single valued, finite

iv. The Fourier transform of the signal $e^{-4|t|}$ is _____. **1**

(a) $8/(16+\omega^2)$ (b) $-8/(16+\omega^2)$

(c) $4/(16+\omega^2)$ (d) $-4/(16+\omega^2)$

v. An LTI system is memoryless only if _____. **1**

(a) It does not store the previous value of the input

(b) It does not depend on any previous value of the input

(c) It does not depend on stored values of the system

(d) It does not depend on the present value of the input

vi. An important property for causality of the system is _____. **1**

(a) It is memoryless (b) Final rest

(c) Initial rest (d) It is unstable

P.T.O.

vii. The impulse response of a LTI system is h(n) = {1,1,1}. What is the response of the signal to the input x(n) = {1,2,3}? **1**
(a) {1,3,6,3,1} (b) {1,2,3,2,1}
(c) {1,3,6,5,3} (d) {1,1,1,0,0}

viii. An LTI system is said to be causal if and only if? **1**
(a) Impulse response is non-zero for positive values of n
(b) Impulse response is zero for positive values of n
(c) Impulse response is non-zero for negative values of n
(d) Impulse response is zero for negative values of n

ix. What is the set of all values of z for which X(z) attains a finite value? **1**
(a) Radius of convergence
(b) Radius of divergence
(c) Feasible solution
(d) None of these

x. The ROC of the Z-transform of the sequence (5/6)nu(n) – (6/5)n u(-n-1) must be- **1**
(a) $|z| > 5/6$ (b) $|z| < 5/6$ (c) $|z| \geq 5/6$ (d) None of these

Q.2 i. Explain the concepts of impulse and unit step function. **3**

ii. (a) Find whether the signals are power, energy or neither energy nor power signals. **7**
I. $x(n) = (1/3)^n$: for $n \geq 0$ and 0 ; for $n < 0$,
II. $x(n) = (1/4)^n$: for $n \geq 0$ and 2n ; for $n < 0$,
(b) Determine whether following signals are periodic or not, if periodic determine fundamental time period?
I. 8 cos(4t) cos(6t) II. cos [4n] + sin [2n]

OR iii. (a) For given signal x(t) = 2u(t) + 2u(t–1) – 4u(t–2). Perform following operations and plot graphically for: **7**
I. x(t– 2) II. x(t+2)
(b) Write any three comparison between periodic and aperiodic signals.

Q.3 i. Write expression for trigonometric & exponential Fourier series for a periodic signal. Define a_n b_n & a_0. **3**

ii. Explain in detail the various properties of fourier transform. **7**

OR iii. Discus various symmetry conditions for a signal. For given periodic signal x(t) = 2 + cos2t + sin4t, determine fundamental frequency & fourier series coefficient c_n? **7**

Q.4 i. Discuss following properties of continuous time system with example. **3**
(a) Linearity (b) Causal

ii. Explain convolution graphically for a continuous time signal with example. **7**

OR iii. What is continuous time system? Explain its properties in detail. **7**

Q.5 i. Discuss following properties of discrete time system with example. **3**
(a) Stable & unstable system
(b) Time-variant & time-invariant system

ii. Determine the convolution sum of following signals: x(n)={ 1, -2, 3}, h(n) = { 0, 0, 1, 1, 1, 1}, Use analytical and graphical method. **7**

OR iii. Give classification of discrete time systems. Explain each in brief. **7**

Q.6 i. Define region of convergence (ROC). How is the ROC defined for causal and anti-causal sequence? **3**

ii. For the system described by the difference equation, y(n) – 0.1 y(n -1) + 0.02y (n -2) = 2x(n) – x(n – 1) Find y(n) for $n \geq 0$ using z transform when x(n) = u(n) and the initial conditions are y(-1) = -10 and y(-2) = 5 **7**

OR iii. Explain the properties of z transform in detail. **7**

****

Marking Scheme
EE3CO27 Signals & Systems

Q.1	i)	b) a power signal	**1**
	ii)	d) $0 < P < \infty$ and $E = \infty$	**1**
	iii)	d) f(x) is a periodic, single valued, finite	**1**
	iv)	a) $8/(16+\omega^2)$	**1**
	v)	b) It does not depend on any previous value of the input	**1**
	vi)	c) Initial rest	**1**
	vii)	c) {1,3,6,5,3}	**1**
	viii)	d) Impulse response is zero for negative values of n	**1**
	ix)	a) Radius of convergence	**1**
	x)	a) $\|z\| > 5/6$	**1**
Q.2	i.	Explain the concepts of impulse and unit step function.	**1.5,1.5**
	ii.	a) Find whether the signals are power, energy or neither energy nor power signals. i) $x(n) = (1/3)n$: for $n \geq 0$ and 0 ; for $n < 0$, ii) $x(n) = (1/4)n$: for $n \geq 0$ and $2n$; for $n < 0$,	**3.5**
		b) Determine whether following signals are period or not, if periodic determine fundamental time period? i) $8\cos(4t)\cos(6t)$ ii) $\cos[4n] + \sin[2n]$	**3.5**
OR	iii.	a) For given signal $x(t) = 2u(t) + 2u(t-1) - 4u(t-2)$. Perform following operations and plot graphically: $x(t-2)$	**4**
		b) Compare periodic and aperiodic signals. (Any three)	**3**
Q.3	i.	Write expression for trigonometric & exponential Fourier series for a periodic signal. Define a_n b_n & a_0?	**1*3=3**
	ii.	Explain in details the various properties of Fourier Transform.	**7**
OR	iii.	Various symmetry conditions for a signal.	**3**
		Fundamental frequency & Fourier series coefficient c_n	**1,3**
Q.4	i.	Discuss following properties of continuous time system with example? (a) Linearity (b)Causal	**1.5,1.5**
	ii.	Determine the convolution sum of following signals – x(n)={ 1, -2, 3}, h(n) = { 0, 0, 1, 1, 1, 1}, Use analytical and graphical method.	**3.5,3.5**
OR	iii.	What is continuous time system. Explain its properties in detail.	**2,5**
Q.5	i.	Discuss following properties of discrete time system with example? (a) Stable & unstable system (b)Time-variant & time-invariant system	**1.5,1.5**
	ii.	Determine the impulse response of the system described by the difference equation $y(n) = 0.6\, y(n-1) - 0.08\, y(n-2) + x(n)$.	**7**
OR	iii.	Give classification of discrete time systems. Explain each in brief.	**7**
Q.6	i.	Define region of convergence (ROC). How is the ROC defined for causal and anti-causal sequence.	**1,2**
	ii.	For the system described by the difference equation, $y(n) - 0.1\, y(n-1) + 0.02y(n-2) = 2x(n) - x(n-1)$ Find y(n) for $n \geq 0$ using z transform when $x(n) = u(n)$ and the initial conditions are $y(-1) = -10$ and $y(-2) = 5$	**7**
OR	iii.	Explain the properties of z transform in detail.	**7**

******