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

Enrollment No.....

Faculty of Engineering

End Sem (Odd) Examination Dec-2022

EC3CO23 Signals and Systems

Programme: B.Tech. Branch/Specialisation: EC

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. The cross correlation of orthogonal signals is- **1**

(a) Zero (b) 1 (c) Infinity (d) None of these

ii. If x(t) is an energy signal, then- **1**

(a) Its energy is finite and power is also finite

(b) Its energy is finite and power is infinite

(c) Its energy is finite and power is zero

(d) None of these

iii. If the time domain signal is continuous then its Fourier transform is- **1**

(a) Continuous (b) Discrete

(c) Periodic (d) Aperiodic

iv. The bandwidth required to transmit an impulse function is- **1**

(a) Zero (b) Infinite (c) Unity (d) None of these

v. If we convolve two signals in time domain then in frequency domain their individual spectrum gets- **1**

(a) Added (b) Subtracted

(c) Multiplied (d) None of these

vi. Which among the following systems are described by partial differential functions? **1**

(a) Causal Systems and dynamic systems

(b) Distributed parameter systems and linear systems

(c) Distributed parameter systems and dynamic systems

(d) Causal systems and linear systems

vii. What is the convolution of a signal with an impulse? **1**

(a) Signal itself (b) Impulse

(c) A new signal (d) Signal multiplied by impulse

P.T.O.

viii. If a signal x(n) is passed through a system to get an output signal of y(n)=x(n+1), then the signal is said to be- **1**

(a) Delayed (b) Advanced
(c) No operation (d) None of these

ix. A discrete-time signal x[n] =δ [n-3] +2δ [n-5] has a z-transform X (z). If Y(z)=X(-z) is the z-transform of another signal y[n], then- **1**

(a) y[n] = x[n] (b) y[n] = x[-n]
(c) y[n] = -x[n] (d) y[n] = -x[n]

x. Find x(∞) if $X(z)=\dfrac{z+3}{(z+1)(z+2)}$ **1**

(a) ∞ (b) -1 (c) 1 (d) 0

Q.2 i. What are orthogonal signals? Explain two explications of orthogonal signals. **2**

ii. Find out the even and odd part of U(t). **3**

iii. Define impulse function. Discuss any four properties. **5**

OR iv. Define the following with one example each- **5**

(a) Even and odd signals
(b) Energy and power signal
(c) Analog signal and digital signal
(d) Causal and non-causal signal
(e) Periodic and aperiodic signal

Q.3 i. State Dirichlet conditions for the existence of Fourier transform. **2**

ii. State and prove the time division convolution theorem. Also explain its physical significance. **8**

OR iii. Find the DTFT of the signal $x(n)$ given by $x(n)=u(n)-u(n-N)$; where N is any positive integer. Determine the magnitude and phase components for N=5. **8**

Q.4 i. Define convolution integral. Discuss its applications. **3**

ii. A discrete-time system have an input $x[n]$ and output as $y[n]=x[n-1]$. Determine whether the system is- **7**

(a) Memoryless (b) Causal
(c) Linear (d) Time-invariant
(e) Stable

OR iii. A system is formed by connecting two systems in cascade mode. The impulse responses of the systems are given by $h_1(t)$ and $h_2(t)$ respectively, and $h_1(t)=e^{-2t}u(t)$; $h_2(t)=2e^{-t}u(t)$. **7**

(a) Find the impulse response $h(t)$ of the overall systems.
(b) Determine if the overall system is BIBO stable.

Q.5 i. A causal LTI discrete-time system satisfying the difference equation $y[n]=x[n]-2x[n-2]+x[n-3]$. Find out the impulse response $h[n]$ of this system. Also, find whether the system is FIR or an IIR system. **4**

ii. Determine the response of the system characterized by the impulse response $h(n)=\left(1/3\right)^n u(n)$ to the input signal $x(n)=3^n u(n)$. **6**

OR iii. Discuss convolution sum and its properties. **6**

Q.6 Attempt any two:

i. Explain ROC and its properties. **5**

ii. Consider the sequence- **5**

$$x[n]=\begin{cases}a^n, & 0\le n\le N-1, a>0\\ 0\ , & otherwise\end{cases}$$

Find $X[z]$ and plot the poles and zeros of $X[z]$.

iii. Discuss the relationship between the Z-transform and Laplace transform. **5**

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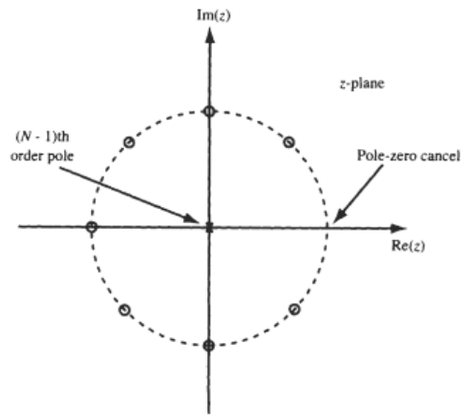
Marking Scheme
EC3CO23 Signal and System

Q.1	i)	a) zero	**1**
	ii)	c) its energy is finite and power is zero	**1**
	iii)	d) aperiodic	**1**
	iv)	b) infinite	**1**
	v)	c) multiplied	**1**
	vi)	c) Distributed parameter systems and Dynamic systems	**1**
	vii)	a) Signal itself	**1**
	viii)	b) Advanced	**1**
	ix)	c) y[n] = -x[n]	**1**
	x)	d) 0	**1**
Q.2	i.	Definition - 1 mark Each application- 0.5 mark	**2**
	ii.	Even part: 1.5 marks Odd part: 1.5 marks	**3**
	iii.	Definition of impulse function – 1 mark Each of the four properties – 1 mark each	**5**
OR	iv.	Definition with example – 1 mark each	**5**
Q.3	i.	Conditions- 0.5 marks for each	**2**
	ii.	Statement – 1 marks Proof – 5 marks Physical significance – 2marks	**8**
OR	iii.	DTFT – 4 marks Magnitude component – 2 marks Phase component – 2 marks	**8**
Q.4	i.	Definition – 1 mark Application -2 marks	**3**
	ii.	a) **not memoryless** – 1.5 marks b) **causal** -1.5 marks c) **linear** – 1.5 marks d) **time-invariant** – 1.5 marks e) **BIBO Stable** – 1 mark	**7**
OR	iii.	a) $h(t) = 2(e^{-t} - e^{-2t})u(t)$ - 4 marks b) The system is BIBO stable - 3 marks	**7**

Q.5	i.	$h[n] = \{1, 0, -2, 1\}$ - 2 marks Since $h[n]$ has only 4 terms – FIR - 2 marks	**4**
	ii.	$y[n] = y_{-1}a^{n+1} + k\dfrac{b^{n+1} - a^{n+1}}{b-a}u[n]$, do step marking also	**6**
OR	iii.	Do step marking depending upon the explanation – max. 6 marks	**6**
Q.6		Attempt any two	
	i.	1 mark for each property	**5**
	ii.	$X[z] = \dfrac{1}{z^{N-1}}\dfrac{z^N - a^N}{z-a}$ 2 marks  3 marks	**5**
	iii.	Do step marking	**5**

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