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

Enrollment No.....

Faculty of Engineering

End Sem Examination May-2023

EE3EL03 / EX3EL03 Digital Signal Processing

Programme: B.Tech. Branch/Specialisation: EE/EX

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. Assume suitable data if necessary. Notations and symbols have their usual meaning.

Q.1 i. The discrete time function defined as u(n)=n for n≥0; u(n)=0 for n<0 is an- **1**

(a) Unit sample signal (b) Unit step signal

(c) Unit ramp signal (d) None of these

ii. Time scaling operation is also known as- **1**

(a) Down-sampling (b) Up-sampling

(c) Sampling (d) None of these

iii. The Region of Convergence (ROC) of the Z transform of a Unit ramp function is- **1**

(a) $|Z| > 1$ (b) $|Z| < 1$

(c) Real part of $Z > 0$ (d) Real part of $Z < 0$

iv. One-sided Z-transform is also known as- **1**

(a) Unilateral Z-transform (b) Bilateral Z-transform

(c) Trilateral Z-transform (d) Multilateral Z-transform

v. What are the Fourier series coefficients for the signal $x(n)=\cos(\pi n/3)$? **1**

(a) c1=c2=c3=c4=0,c1=c5=1/2

(b) c0=c1=c2=c3=c4=c5=0

(c) c0=c1=c2=c3=c4=c5=1/2

(d) None of these

vi. Which technique is used to obtain a discrete-time signal from a continuous-time signal? **1**

(a) Differentiating (b) Convolution

(c) Integrating (d) Sampling

P.T.O.

vii. Find the complex multiplications required for 16 direct computations of DFT. **1**
(a) 854 (b) 56 (c) 992 (d) 240

viii. Determine the number of complex additions required for 32 direct computations of DFT. **1**
(a) 216 (b) 256 (c) 1024 (d) 16

ix. The advantages of FIR filters are- **1**
(a) Stable (b) Realized in recursive
(c) Realized in non-recursive (d) All of these

x. A digital signal processing system is defined by: **1**
$y(n) = 2x(n) + x(n-1) + 2y(n-1)$, The system is-
(a) A stable IIR filter
(b) A stable FIR filter
(c) An unstable IIR filter
(d) An unstable FIR filter

Q.2 i. Explain linear shift invariant systems with an example. **2**

ii. What are the conditions for stability and causality of an LSI system? **3**

iii. Determine the total response $y(n)$, $n \geq 0$ to the difference equation $x(n) = y(n) + a_1 y(n-1)$. Where $x(n)$ is a unit step sequence $x(n) = u(n)$ and $y(-1)$ is the initial condition. **5**

OR iv. Write and explain five properties of the discrete time Fourier transform. **5**

Q.3 i. Explain in detail stability criterion using Z transform. **4**

ii. Explain in detail one sided Z transform and its three applications. **6**

OR iii. Determine the Z transform of the following discrete time signals: **6**
(a) $s(n) = \sin(\omega_0 n)\, u(n)$ (b) $s(n) = nu(n)$

Q.4 i. Write and explain four properties of Fourier transform for discrete time signals. **4**

ii. Explain frequency analysis of discrete time signals in detail with example. **6**

OR iii. Explain in detail with example the linear invariant system as frequency selective filter. **6**

Q.5 i. Write four properties of discrete Fourier series. **4**

ii. What are inverse systems? Explain de-convolution with an example. **6**

OR iii. Calculate the eight-point DFT for the following: **6**
$x(n) = [1,2,3,4,5,6,7,8]$

Q.6 Attempt any two:

i. Explain IIR filter design using least square method. **5**

ii. State five comparisons of IIR and FIR filters. **5**

iii. Explain FIR filter design using windowing method. **5**

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[4]

[1]

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Marking Scheme

EE3EL03-EX3EL03 (T) Digital Signal Processing

Q.1	i)	(c) Unit ramp signal	**1**
	ii)	(a) Down-sampling	**1**
	iii)	(a) |Z| >1	**1**
	iv)	(a) Unilateral Z-transform	**1**
	v)	(a) c1=c2=c3=c4=0,c1=c5=1/2	**1**
	vi)	(d) Sampling	**1**
	vii)	(c) 992	**1**
	viii)	(b) 256	**1**
	ix)	(d) All of these	**1**
	x)	(c) An unstable IIR filter	**1**
Q.2	i.	linear shift invariant systems	**2**
	ii.	conditions for stability and causality	**1.5x2**
	iii.	total response with steps	**2,2,1**
OR	iv.	Write and explain five properties	**1x5**
Q.3	i.	stability criterion	**4**
	ii.	Explain in detail one sided z transform and its applications	**4,2**
OR	iii.	Explain in detail with example	**4,2**
Q.4	i.	four properties	**1x4**
	ii.	Explain in detail with example	**4,2**
OR	iii.	Explain in detail with example	**4,2**
Q.5	i.	four Properties	**1x4**
	ii.	What are inverse systems? Explain de-convolution with an example.	**2,4**
OR	iii.	Calculate the eight point DFT	**3,3**
Q.6			
	i.	Explain IIR filter design using least square method.	**5**
	ii.	Five comparisons of IIR and FIR filters	**1x5**
	iii.	Explain FIR filter design using windowing method	**5**