



BRAINWARE UNIVERSITY

Term End Examination 2020 - 21

Programme – Diploma in Electronics & Communication Engineering

Course Name – Digital Signal Processing

Course Code - DECE505C

Semester / Year - Semester V

Time allotted : 85 Minutes

Full Marks : 70

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question)

1 x 70=70

1. (Answer any Seventy)

(i) The process of conversion of continuous time signal into discrete time signal is known as

- | | |
|----------------|-------------|
| a) sampling | b) aliasing |
| c) convolution | d) decoding |

(ii)

The sampling frequency of the following analog signal, $x(t) = 20\sin 250\pi t + 2\cos 50\pi t$ should be,

- | | |
|-----------------------|-----------------------|
| a) greater than 50Hz | b) greater than 250Hz |
| c) greater than 125Hz | d) less than 250Hz |

(iii) Which of the following signal is the example for deterministic signal ?

- | | |
|----------------|-----------------|
| a) step | b) ramp |
| c) exponential | d) all of these |

(iv) A signal is a physical quantity which does not vary with _____

- | | |
|--------------------------|------------------------|
| a) time | b) dependent variables |
| c) independent variables | d) space |

(v) For an energy signal _____

- | | |
|------------|------------|
| a) $E = 0$ | b) $P = 0$ |
|------------|------------|

c)

$$E = \infty$$

d)

$$P = \infty$$

(vi) In real valued function and complex valued function, time is

a) real

b) complex

c) imaginary

d) not predictable

(vii) Discrete time signal is derived from continuous time signal by _____ process

a) addition

b) multiplying

c) sampling

d) addition and multiplication

(viii) Determine the odd component of the signal $x(t) = \cos t + \sin t$

a) $\sin t$

b) $\cos t$

c) $2\cos t$

d) $2\sin t$

(ix) If $x(-t) = -x(t)$ then the signal is said to be _____

a) even signal

b) odd signal

c) periodic signal

d) non periodic signal

(x) A LTI system is said to be initially relaxed system only if ____

a) zero input produces zero output

b) zero input produces an output equal to unity

c) zero input produces non-zero output

d) none of these

(xi) Noise generated by an amplifier of radio is an example of

a) discrete signal

b) deterministic signal

c) periodic signal

d) random signal

(xii) What is a fundamental period?

- a) every interval of a periodic signal
- b) every interval of an aperiodic signal
- c) the first interval of a periodic signal
- d) the last interval of a periodic signal

(xiii) Which among the following operation is not involved with the computation process of linear convolution?

- a) folding operation
- b) shifting operation
- c) multiplication operation
- d) integration operation

(xiv) What is the possible range of frequency spectrum for discrete time Fourier series (DTFS)?

- a) 0 to 2π
- b) $-\pi$ to $+\pi$
- c) both 0 to 2π & $-\pi$ to $+\pi$
- d) none of these

(xv) Which block of the discrete time systems requires memory in order to store the previous input?

- a) adder
- b) signal multiplier
- c) unit advance
- d) unit delay

(xvi) Which representation does not exist in discrete time signals

- a) tabular representation
- b) functional representation
- c) shifting representation
- d) graphical representation

(xvii) If a periodic signal $x(t)$ has an even symmetry, the Fourier expansion contains

- a) only sine terms
- b) only cosine terms
- c) constant and cosine terms
- d) both sine and cosine terms

(xviii) If $x(t)$ is even, then its Fourier series coefficients must be

- a) real and even
- b) imaginary and odd
- c) real and odd
- d) imaginary and even

(xix) Continuous time non-periodic signal have

- a) periodic continuous spectra
- b) aperiodic discrete spectra
- c) aperiodic continuous spectra
- d) periodic discrete spectra

(xx) If $x(n)$ is a sequence of L number of samples and $h(n)$ with M number of samples, after linear convolution $y(n)$ will contain

- a) $L+M$ samples
- b) $L+M-1$ samples
- c) $L+M+1$ samples
- d) $L+M+L$ samples

(xxi) Should real time instruments like oscilloscopes be time invariant?

- a) yes
- b) sometimes
- c) never
- d) they have no relation with time variance

(xxii) Amplifiers, motors, filters etc. are examples for which type of system?

- a) Distributed parameter systems
- b) Unstable systems
- c) Discrete time systems
- d) continuous time systems

(xxiii) The type of systems which are characterized by input and the output quantized at certain levels are called as

- a) discrete
- b) digital
- c) continuous
- d) analog

(xxiv) The system $y(n) = x(n) x(n-3)$ is

- a) dynamic and time variant
- b) dynamic and linear
- c) causal and time invariant
- d) noncausal and time variant

(xxv) The system $y(n+3) + y(n+2) = x(n+2)$ is

- a) causal and memory less
- c) not causal

- b) causal and has memory
- d) causal

(xxvi) The sampling process converts

- a) continuous time signal into continuous time signal
- c) discrete time signal into a continuous time signal

- b) continuous time signal into a discrete time signal
- d) discrete time signal into discrete time signal

(xxvii) The quantization error in discrete time signal has

- a) gaussian distribution
- c) poissons distribution

- b) uniform distribution
- d) none of these

(xxviii) The spectrum of a rectangular pulse is

- a) gaussian function
- c) rectangular function

- b) sinc function
- d) triangular function

(xxix) A band pass signal extends from 2 kHz to 3 kHz. The minimum sampling frequency needed to retain all information in the sampled signal is

- a) 1 kHz
- c) 4 kHz

- b) 6 kHz
- d) 2 kHz

(xxx) All causal systems must have the component of

- a) stability
- c) memory

- b) linearity
- d) time invariance

(xxxi) What is single-valued function?

- a) single value for all instants of time
- c) a single pattern is followed by after 't' intervals

- b) unique value for every instant of time
- d) different pattern of values is followed by after 't' intervals of time

(xxxii) What is the value of $u[1]$, where $u[n]$ is the unit step function?

- a) -1
- b) 0.5
- c) 1.5
- d) 1

(xxxiii) The number of bits required to represent a 256 level quantization in discrete time signal is

- a) 7
- b) 8
- c) 5
- d) 6

(xxxiv) Given a unit step function $u(t)$. Its time derivative is

- a) a unit impulse
- b) another step function
- c) a unit ramp function
- d) a sine function

(xxxv) If an input signal is applied to two LTI systems with impulse response $h(t)$ and $2h(t-2)$, then the response of the second system is the response of the first with

- a) amplitude scaled by 2 and delayed by 2
- b) amplitude scaled by 2 and advanced by 2
- c) delayed by 2
- d) amplitude scaled by 2

(xxxvi) The signal $y(n) = n[x(n)]$ is

- a) linear and time invariant system
- b) linear and time variant system
- c) non-linear time invariant system
- d) non-linear time variant system

(xxxvii) Determine the odd component of the signal $x(t) = u(t)$

- a) 2sint
- b) sint
- c) cost
- d) none of these

(xxxviii) The Ramp function $r(t)$ is integral of _____ with respect to time t

- a) ramp function
- b) step function
- c) sinusoidal function
- d) impulse function

(xxxix) Determine the even components of the signal $x(t) = u(-t)$

- a) $\sin t$
- b) $\cos t$
- c) $2\cos t$
- d) none of these

(xl) Which among the following operations are involved with the computation process of linear convolution?

- a) folding operation
- b) shifting operation
- c) multiplication operation
- d) all of these

(xli) ROC of unit step function is

- a) $|z| < 1$
- b) $|z| > 1$
- c) $|z| = 1$
- d) none of these

(xlii) ROC of a causal LTI system

- a) is the entire S plane
- b) is the right half of S plane
- c) is the left half of S plane
- d) does not exist

(xliii) A discrete time system is stable if and only if the ROC of $H(Z)$

- a) excludes $|z|=1$
- b) includes $|z|=1$
- c) Both excludes $|z|=1$ & includes $|z|=1$
- d) none of these

(xliv) The trigonometric Fourier series of an even function of time does not have the

- a) dc terms
- b) cosine terms
- c) sin terms
- d) odd harmonic terms

(xlv) Which theorem states that the total average power of a periodic signal is equal to the sum of average powers of the individual Fourier coefficients?

- a) parseval's theorem
- b) rayleigh's theorem
- c) Both parseval's theorem & rayleigh's theorem
- d) none of these

(xlvi) Unilateral Laplace Transform is applicable for the determination of linear constant coefficient differential equations with _____

- a) zero initial condition
- b) non-zero initial condition
- c) zero final condition
- d) non-zero final condition

(xlvii) Which among the following belongs to the category of non-recursive systems?

- a) non causal FIR systems
- b) causal FIR systems
- c) causal IIR systems
- d) non-causal IIR systems

(xlviii) What is the DFT of the four point sequence $x(n)=\{0,1,2,3\}$?

- a) $\{6,-2+2j,-2,-3-2j\}$
- b) $\{7,-2-2j,2,-2+2j\}$
- c) $\{6,-2-2j,-2,-2+3j\}$
- d) $\{6,-2+2j,-2,-2-2j\}$

(xlix) The function which has its Laplace transform unity is

- a) sinc
- b) ramp
- c) impulse
- d) gaussian

(l) The ROC of the sequence $x(n)=u(-n)$ is

- a) $|z| > 1$
- b) $|z| < 1$
- c) no ROC
- d) $-1 < |z| < 1$

(li)

The power of the signal $x(t) = 5\cos(50t + \frac{\pi}{3})$ is

- a) 215W
- b) 125W
- c) 250W
- d) 12.5W

(lii)

The time reversal of a sequence $x(n)$ can be obtained by folding the sequence at $n=0$. It is denoted as

- | | |
|---------|-------------|
| a) | b) $x(-2n)$ |
| $x(-n)$ | |
| c) | d) |
| x^n | x^{2n} |

(liii) Aliasing occurs, when Nyquist rate is

- | | |
|-----------|-----------|
| a) | b) |
| $2 f_m$ | $3 f_m$ |
| c) | d) |
| $2.5 f_m$ | $1.2 f_m$ |

(liv)

Minimum sampling rate for a signal of bandwidth f_m

- | | |
|--------------|--------------|
| a) | b) |
| $f_s = f_m$ | $f_s = 3f_m$ |
| c) | d) |
| $f_s = 4f_m$ | $f_s = 2f_m$ |

(lv)

If $x(t)$ is both real and even, then $X(j\Omega)$ will be

- | | |
|----------------|---------------------|
| a) real & odd | b) imaginary & odd |
| c) real & even | d) imaginary & even |

(lvi)

Which one of the following is not a ramp function?

a)

$$r(t) = t \text{ when } t \geq 0$$

b)

$$r(t) = 0 \text{ when } t < 0$$

c)

$$r(t) = \int u(t) dt \text{ when } t < 0$$

d)

$$\frac{du(t)}{dt}$$

(lvii)

Determine if the systems described by the following input-output equations are linear or non-linear. (1)

$$y(n) = x^2(n); \quad (2) \quad y(n) = nx(n)$$

a)

equ. 1 is linear but 2 is non-linear

b)

equ. 2 is linear but 1 is non-linear

c)

equ. 1 and 2 both are linear

d)

equ. 1 and 2 both are non-linear

(lviii)

The system defined as $y(n) = 2x(n) + 3x(n^2)$ is

a)

static and causal

b)

dynamic and causal

c)

static and non-causal

d)

dynamic and non-causal

(lix)

A signal is given by the equation $x(n) = (\frac{1}{3})^n u(n)$. The signal is

- | | |
|------------------------------|---------------------------------|
| a) | b) |
| an energy signal | a power signal |
| c) | d) |
| both energy and power signal | neither energy nor power signal |

(lx)

Which mathematical notation specifies the condition of periodicity for a continuous time signal?

- | | |
|------------------------|-----------------------|
| a) | b) |
| $x(t) = e^{-\alpha t}$ | $x(t) = e^{\alpha t}$ |
| c) | d) |
| $x(t) = x(t + T)$ | $x(n) = x(n + N)$ |

(lxi)

$X_1(t) = 2\sin\pi t + \cos 4\pi t$ and $X_2(t) = \sin 5\pi t + 3\sin 3\pi t$

- | | |
|---------------------------------------|---------------------------------------|
| a) | b) |
| X_1 and X_2 both are periodic | X_1 and X_2 both are aperiodic |
| c) | d) |
| X_1 is periodic and X_2 aperiodic | X_1 is aperiodic and X_2 periodic |

(lxii)

Which of the following system is causal?

a)

$$h(n) = n \left(\frac{1}{2}\right)^n u(n+1)$$

c)

$$y(n) = x(-n) + x(2n-1)$$

b)

$$y(n) = x^2(n) - x(n+1)$$

d)

$$h(n) = n \left(\frac{1}{2}\right)^n u(n)$$

(lxiii)

Sampling rate for reproduction of original signal must be

a)

$$< f_m$$

c)

$$> 2f_m$$

b)

$$> f_m$$

d) none

(lxiv)

The signal $x(n) = e^{j\frac{3}{5}(n+1/2)}$

a)

is periodic with period 3/5

c)

is non-periodic

b)

is periodic with period 1/2

d)

none of these

(lxv)

If $X(z)$ is the z-transform of the signal $x(n]$, then what is the z-transform of the signal $x(-n)$?

a)

b)

$$X(-z)$$

$$X(z^{-1})$$

c)

d) none of these

$$X^{-1}(z)$$

(lxvi)

What is the z-transform of the signal defined as $x(n)=u(n)-u(n-N)$?

a)

b)

$$\frac{1+z^N}{1+z^{-1}}$$

$$\frac{1-z^N}{1+z^{-1}}$$

c)

d)

$$\frac{1+z^{-N}}{1+z^{-1}}$$

$$\frac{1-z^{-N}}{1-z^{-1}}$$

(lxvii)

What is the Laplace transform of $\cos 2t$?

a)

b)

$$s/(s^2+4)$$

$$\frac{\sin x}{x}$$

c)

d)

$$\frac{\operatorname{cosec} x}{x}$$

$$\frac{\tan x}{x}$$

(lxviii)

If $\text{DFT}\{x(n)\}=X(k)$, then $\text{DFT}\{x(n+m)_N\}$

a)

b)

$$X(k) e^{\frac{-j2\pi km}{N}}$$

c)

$$X(k) e^{\frac{j2\pi km}{N}}$$

$$X(k) e^{\frac{-j2\pi k}{mN}}$$

d)

$$X(k) e^{\frac{j2\pi k}{mN}}$$

(lxix)

The Fourier transform of correlation sequence of two discrete time signals $x_1(n)$ and $x_2(n)$ is given by

a)

$$X_1(e^{j\omega})X_2(e^{j\omega})$$

c)

$$X_1(e^{-j\omega})X_2(e^{-j\omega})$$

b)

$$X_1(e^{j\omega})X_2(e^{-j\omega})$$

d) none of these

(lxx)

If a continuous time signal $x(t)$ has a nyquist rate of Ω_0 , then nyquist rate for the continuous time signal $x^2(t)$ is

a)

$$\frac{\Omega_0}{2}$$

c)

$$\frac{\Omega_0}{4}$$

b)

$$2 \Omega_0$$

d)

$$\Omega_0$$