University of Mumbai

Signal And System

MCQ

Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**
1.	The signal x(t)=sin(5t)/πt is
Option A:	An energy signal with energy 5/π
Option B:	An energy signal with energy 5π
Option C:	An energy signal with energy 10/π
Option D:	A power signal with power 10π
2.	Which of the following is a time invariant system
Option A:	$y(t) = tx(t)$
Option B:	$y(t) = x(-t)$
Option C:	$y(t) = e^{x(t)}$
Option D:	$y(t) = x(t^2)$
3.	The signal $e^{j\Omega_0 n}$ is periodic
Option A:	For any value of Ω_0
Option B:	Only if Ω_0 is a rational number
Option C:	Only if $\Omega_0/2\pi$ is a rational number
Option D:	Only if $\Omega_0/2\pi$ is an integer
4.	The unit impulse is defined as
Option A:	$\delta(t) = \infty; t = 0$
Option B:	The unit impulse is defined as $\delta(t) = \infty; t = 0$ =0; t≠0
Option C:	$\delta(t) = \infty; t = 0$ and $\int_{-\infty}^{\infty} \delta(t)dt = A$
Option D:	$\delta(t) = \infty; t = 0$ =0; t≠0 and $\int_{-\infty}^{\infty} \delta(t)dt = 1$
5.	For a discrete time LTI system to be stable, the ROC of the z-transform of its impulse response
Option A:	must be of the form $\|z\|>r_{max}$
Option B:	must be of the form $\|z\|<r_{min}$
Option C:	must include the unit-circle
Option D:	must be of the form r1<|z|<r2
6.	Let X(z) denote the z-transform of x(n). The z-transform of nx(n) is

Option A:	$X(z) = -z\frac{dX(z)}{dz}$
Option B:	$X(z) = z\frac{dX(z)}{dz}$
Option C:	$X(z) = zX(z)$
Option D:	$X(z) = \frac{1}{z}\frac{dX(z)}{dz}$
7.	What is the inverse z transform of $X(z) = \frac{z}{3z^2-4z+1}$ if the region of convergence is $\|z\| < \frac{1}{3}$
Option A:	x(n)=$\frac{1}{2}(1)^n u(n) - \frac{1}{2}\left(\frac{1}{3}\right)^n u(n)$
Option B:	x(n)=$\frac{1}{4}(1)^n u(-n-1) - \frac{1}{2}\left(\frac{1}{3}\right)^n u(-n-1)$
Option C:	x(n)={ -$\frac{1}{2}(1)^n + \frac{1}{2}\left(\frac{1}{3}\right)^n$}$u(-n-1)$
Option D:	x(n)= -$\frac{1}{4}(1)^n u(-n-1) + \frac{1}{2}\left(\frac{1}{3}\right)^n u(n)$
8.	Find the final value of the signal corresponding to the z transform $X(z) = \frac{2z^{-1}}{1-1.8z^{-1}+0.8z^{-2}}$
Option A:	**10**
Option B:	1
Option C:	0.8
Option D:	infinity
9.	What does the zero-state response of the system means?
Option A:	Response of the system when initial state of the system is zero
Option B:	Response of the system due to input alone
Option C:	Response of the system due to input alone when initial state of the system is zero
Option D:	Response of the system due to input alone when initial state is neglected
10.	The frequency response of the first order system with difference equation y(n)=x(n)+10y(n-1) with initial condition y(-1)=0 is
Option A:	$H(e^{jw}) = \frac{e^{jw}}{e^{jw}+10}$
Option B:	$H(e^{jw}) = \frac{e^{jw}}{e^{jw}-10}$
Option C:	$H(e^{jw}) = \frac{1}{3}(1+cosw)e^{jw}$
Option D:	$H(e^{jw}) = \frac{cosw - jsinw}{(cosw-10)+jsinw}$
11.	The impulse response of the second order system y(n)-y(n-1)+(3/16) y(n-2)=x(n)-(1/2) x(n-1) is
Option A:	$h(n) = \left[\frac{1}{3}\left(\frac{1}{4}\right)^n + \frac{1}{2}\left(\frac{2}{3}\right)^n\right]u(n)$

Option B:	$h(n) = \left[\frac{1}{2}\left(\frac{1}{4}\right)^n + \frac{1}{2}\left(\frac{3}{4}\right)^n\right] u(n)$
Option C:	$h(n) = \left[\frac{1}{3}\left(\frac{1}{4}\right)^n - \frac{1}{2}\left(\frac{2}{3}\right)^n\right] u(n)$
Option D:	$h(n) = \left[\frac{1}{2}\left(\frac{1}{4}\right)^n - \frac{1}{2}\left(\frac{3}{4}\right)^n\right] u(n)$
12.	In N point DFT of L point sequence , the value of N to avoid aliasing in frequency spectrum is,
Option A:	$N \neq L$
Option B:	$N \leq L$
Option C:	$N \geq L$
Option D:	$N = L$
13.	The complex valued phase factor/twiddle factor W_N can be represented as
Option A:	$e^{-j2\pi N}$
Option B:	$e^{\frac{-j2\pi}{N}}$
Option C:	$e^{-j2\pi}$
Option D:	$e^{-j2\pi kN}$
14.	In an N –point DFT sequence, if N=16, the total number of complex additions and multiplications using Radix-2 FFT are
Option A:	64 and 80
Option B:	80 and 64
Option C:	64 and 32
Option D:	24 and 12
15.	If poles and zeros are in reciprocal then the filter is
Option A:	High pass
Option B:	All pass
Option C:	Low pass
Option D:	Band Pass
16.	An FIR system is described by the system function $H(z) = 1 + \frac{7}{2}z^{-1} + \frac{3}{2}z^{-2}$ The system is
Option A:	Maximum phase
Option B:	Minimum phase
Option C:	Mixed phase
Option D:	Zero phase
17.	A filter is said to be linear phase filter if the phase delay and group delay are _____

Option A:	High
Option B:	Moderate
Option C:	Low
Option D:	Constant
18.	Which among the following represents the characteristics of an ideal filter?
Option A:	Constant gain in pass band
Option B:	Zero gain in stop band
Option C:	Linear Phase Response
Option D:	Constant gain in pass band, Zero gain in stop band and Linear Phase Response
19.	Which of the following condition should be the unit sample response of a FIR filter satisfy to have a linear phase?
Option A:	h(M-1-n) n=0,1,2…M-1
Option B:	±h(M-1-n) n=0,1,2…M-1
Option C:	-h(M-1-n) n=0,1,2…M-1
Option D:	h(M-1) n=0,1,2…M-1
20.	What is the number of filter coefficients that specify the frequency response for h(n) anti-symmetric?
Option A:	(M-1)/2 when M is even and M/2 when M is odd
Option B:	(M-1)/2 when M is odd and M/2 when M is even
Option C:	(M+1)/2 when M is even and M/2 when M is odd
Option D:	(M+1)/2 when M is odd and M/2 when M is even
21.	If x (-t) = x (t) then the signal is said to be _____
Option A:	Even signal
Option B:	Odd signal
Option C:	Periodic signal
Option D:	Non periodic signal
22.	Sum or product of two or more even functions, or product of even number of odd functions results
Option A:	Odd function
Option B:	Even function
Option C:	Even & Odd function
Option D:	Special function
23.	The smallest value of N for which x(n+N)=x(n) is true is called
Option A:	Average period
Option B:	Delayed time
Option C:	Advanced time
Option D:	Fundamental period
24.	If the system does not change with change in parameter like time, then the system is known as?
Option A:	linear system
Option B:	non linear system
Option C:	time invariant

Option D:	time variant
25.	When x(t) is said to be non periodic signal?
Option A:	If the equation x (t) = x (t + T) is satisfied for all values of T
Option B:	If the equation x (t) = x (t + T) is satisfied for only one value of T
Option C:	If the equation x (t) = x (t + T) is satisfied for no values of T
Option D:	If the equation x (t) = x (t + T) is satisfied for only odd values of T
26.	The ROC of u(-n-1) is given by,
Option A:	$\|z\| \geq a$
Option B:	$\|z\| \leq a$
Option C:	$\|z\| = a$
Option D:	$\|z\| \neq a$
27.	Z- transform of a finite duration sequence x(n)= {5, 3 ,0 ,1 ,2 ,4}
Option A:	$5z^3 + 3z^2+1$
Option B:	$2z^{-1} - 4z^{-2}+ 1 + 5z^3 - 3z^2$
Option C:	$2z^{-1}+ 4z^{-2} - 1 + 5z^3 + 3z^2$
Option D:	$5z^3 + 3z^2+1+ 2z^{-1}+ 4z^{-2}$
28.	The inverse Z transform of transfer function is _____ of the system
Option A:	Impulse response
Option B:	Frequency response
Option C:	Magnitude Response
Option D:	Step response
29.	For the system to be non-minimum phase,
Option A:	Poles and zeroes must lie on the right s-plane
Option B:	Zeroes must lie on right of s-plane
Option C:	Both lie on left of s-plane
Option D:	Poles must be on the left and zeroes can be on the right s –plane.
30.	If function X(n) is causal and bounded than all the poles of function X(z) will lie
Option A:	On the unit circle in z-plane
Option B:	Outside the unit circle in z-plane
Option C:	Inside the unit circle in z-plane
Option D:	Within and outside the unity circle
31.	A LTI system is _____-if ∑h(n)<infinity. Here the summation is absolutely summable
Option A:	stable
Option B:	causal
Option C:	unstable
Option D:	time invariant
32.	Which radix is used in DITFFT?
Option A:	Radix-0
Option B:	Radix-1
Option C:	Radix-2

Option D:	Radix-3
33.	Convolution of x(n) * h(n) is given by
Option A:	$\sum_{K=-\infty}^{\infty} x(n)\, h(n-k)$
Option B:	$\sum_{K=-\infty}^{\infty} h(n-K)\, x(n-k)$
Option C:	$x(n) \sum_{K=-\infty}^{\infty} h(n-k)$
Option D:	$x(n) \sum_{K=-\infty}^{\infty} x(n)h(n-k)$
34.	DIT algorithm divides the sequence into
Option A:	Small and large samples
Option B:	Positive and negative values
Option C:	Upper higher and lower spectrum
Option D:	Even and odd samples
35.	Which window technique among the following is used in FIR filter?
Option A:	square window technique
Option B:	circle window technique
Option C:	Triangle window technique
Option D:	rectangular window technique
36.	In FIR design we consider only_____ so that system output is always causal
Option A:	Negative values of the window function are used
Option B:	Positive values of the window function are used
Option C:	Negative and positive values of the window functions are used
Option D:	Half negative and Half positive values of the window functions are used
37.	Which of the following is applicable for linear phase filters
Option A:	Θ(ω) = ω.α
Option B:	Θ(ω) = - ω.α
Option C:	Θ(ω) =± ω.α
Option D:	Θ(ω) =ω2.α
38.	What does IIR stand for?
Option A:	invariance impulse response
Option B:	infinite impulse response
Option C:	interval impulse response
Option D:	intermediate impulse response
39.	The IIR filter designing involves
Option A:	Designing of digital filter into digital domain and transforming into analog domain
Option B:	Designing of analog filter into digital domain and transforming into analog domain
Option C:	Designing of digital filter into analog domain and transforming into digital domain

Option D:	Designing of analog filter into analog domain and transforming into digital domain
40.	Digital filters are governed by which type of mathematical equations
Option A:	Differential Equation
Option B:	Linear Difference Equation
Option C:	Partial Differential Equation
Option D:	Non-linear Equation
41.	What is the fundamental period of the given signal $x(n) = sin\frac{2\Pi n}{3} + cos\frac{2\Pi n}{5}$
Option A:	15
Option B:	17
Option C:	13
Option D:	8
42.	A signal is said to be _____ if the inversion of time does not change the amplitude of the signal else signal is _____
Option A:	Odd and Even
Option B:	Periodic and non-periodic
Option C:	Linear and non-linear
Option D:	Even and odd
43.	Response of the system dependent on present & future inputs are called
Option A:	Static system
Option B:	Dynamic system
Option C:	Causal system
Option D:	Non causal system
44.	Finite sequence $x(n)$ is defined as $x(n) = \{5, 3, -3, 0, 4, -2\}$. Find X
Option A:	$5z^3 + 3z^2 + 1$
Option B:	$5 + 3z^{-1} - 3z^{-2} + 4z^{-4} - 2z^{-5}$
Option C:	$2z^{-1} + 4z^{-2} - 1 + 5z^3 + 3z^2$
Option D:	$5z^3 + 3z^2 + 1 + 2z^{-1} + 4z^{-2}$
45.	DTFT of $x(n) = \alpha^n u(n)$ where $\alpha < 1$
Option A:	$X(e^{j\Omega}) = \frac{1}{1+\alpha e^{j\Omega}}$
Option B:	$X(e^{j\Omega}) = \frac{1}{1-\alpha e^{j\Omega}}$
Option C:	$X(e^{j\Omega}) = \frac{1}{1-e^{j\Omega}}$
Option D:	$X(e^{j\Omega}) = \frac{1}{1-\alpha}$
46.	Discrete time Convolution of x(n)={1, 2 ,3 ,4} & h(n) = {1, 1 ,-1, 1)

Option A:	{1,3,4,6,3, -1,4}
Option B:	{1,3,4,6, 3,-1,4,0}
Option C:	{1,3 ,4, -1,4}
Option D:	{1,3,4,6,}
47.	No of stages in the FFT design using butterfly structure is calculated by
Option A:	$log_2 N$ in N-point FFT
Option B:	$log_{10} N$ in N-point FFT
Option C:	$Nlog_{10} 1$ in N-point FFT
Option D:	$N\ log_2 1$ in N-point FFT
48	In FIR design we consider only_____ so that system output is always causal
Option A:	Negative values of the window function are used
Option B:	Positive values of the window function are used
Option C:	Negative and positive values of the window functions are used
Option D:	Half negative and Half positive values of the window functions are used
49.	Window function used in FIR is used to convert
Option A:	Finite impulse response to infinite impulse response
Option B:	Infinite impulse response to Finite impulse response
Option C:	Infinite impulse response to infinite impulse response
Option D:	Finite impulse response to Finite impulse response
50.	If the i/p & o/p characteristic of the system changes with time, the system is called to be
Option A:	Time invariant system
Option B:	Linear system
Option C:	Time variant system
Option D:	Non- Linear system
51.	A signal is said to be Energy/Power signal if total Energy/Power of the signal is
Option A:	Finite
Option B:	Infinite
Option C:	Zero
Option D:	Unity
52.	The even part of the signal x(t) is
Option A:	1/2 * (x(t) + (-t))
Option B:	x(t) – x (-t)
Option C:	1/2 * (x(t) - (-t))
Option D:	x(t) – x (-t)
53.	For Bilinear Transformation conversion of digital frequency into analog frequency is given by
Option A:	$\Omega = \frac{2}{Ts}\ cos(\frac{2}{\omega})$
Option B:	$\Omega = \frac{2}{Ts}\ \tan(\frac{\omega}{2})$

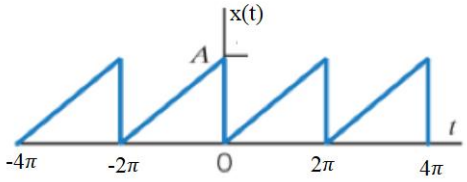
Option C:	$\Omega = \frac{2}{Ts}\, sin(\frac{\omega}{2})$
Option D:	$\Omega = \frac{2}{Ts}\, \tan(\frac{2}{\omega})$
54.	Response of causal system depends on
Option A:	Past and Present inputs
Option B:	Past , present and future inputs
Option C:	Only present
Option D:	Only Past
55.	Hamming window used in FIR filter is represented by
Option A:	$\omega_h(n) = 0.54 + 0.46 \left\{\frac{2\Pi n}{M-1}\right\}$
Option B:	$\omega_h(n) = 0.46 + 0.54 \left\{\frac{2\Pi n}{M-1}\right\}$
Option C:	$\omega_h(n) = 0.45 + 0.64 \left\{\frac{2\Pi n}{M-1}\right\}$
Option D:	$\omega_h(n) = 0.64 + 0.45 \left\{\frac{2\Pi n}{M-1}\right\}$
56.	Convolution of x(n) * h(n) is given by
Option A:	$\sum_{K=-\infty}^{\infty} x(n)\, h(n-k)$
Option B:	$\sum_{K=-\infty}^{\infty} h(n)\, x(n-k)$
Option C:	$x(n) \sum_{K=-\infty}^{\infty} h(n-k)$
Option D:	$x(n) \sum_{K=-\infty}^{\infty} x(n)h(n-k)$
57.	Z-transform of $x(n) = \left(\frac{1}{5}\right)^n [u(n) - u(n-5)$
Option A:	$\frac{z^4 - (0.2)^5}{z^4\left(z - \frac{1}{5}\right)}$
Option B:	$\frac{z^5 - (0.2)^4}{z^4\left(z - \frac{1}{5}\right)}$

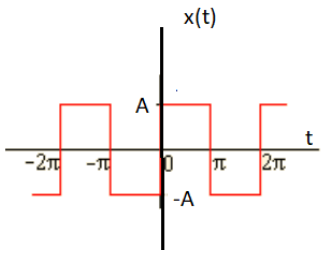
Option C:	$\frac{z^5-(0.1)^5}{z^4\left(z-\frac{1}{5}\right)}$
Option D:	$\frac{z^5-(0.2)^5}{z^4\left(z-\frac{1}{5}\right)}$
58.	Sum of two or more even function or product of two or more even or product of even number of odd functions results in
Option A:	Even function
Option B:	Odd function
Option C:	Even & Odd function
Option D:	Even or Odd function
59.	Which filters exhibit their dependency upon the system design for the stability purpose?
Option A:	FIR
Option B:	IIR
Option C:	Equi-ripple filter
Option D:	Chebyshev filter
60.	If all the poles does not lie in unit circle of ROC in z- transform than the system is said to be
Option A:	Unbounded and non-causal
Option B:	Bounded and non-causal
Option C:	Bounded and causal
Option D:	Unbounded and causal
61	What are the conditions called which are required for a signal to fulfil to be represented as Fourier series?
Option A:	**Dirichlet's conditions**
Option B:	Gibbs phenomenon
Option C:	Fourier conditions
Option D:	Fourier phenomenon

DESCRIPTIVE QUESTIONS

1.	A discrete time LTI system is described by the difference equation y(n)=x(n)+0.8x(n-1)+0.8x(n-2)-0.49y(n-2) Determine the transfer function and draw pole zero plot in z-domain.
2.	Determine the inverse Z transform of $\frac{1}{1-\frac{3}{2}z^{-1}+\frac{1}{2}z^{-2}}$ when ROC $a)\ \|Z\|>1\ b)\ \|Z\|<1/2$
3.	Find X(K) by using DIT-FFT algorithm x(n) = {1,2,3,4,4,3,2,1}
4.	Check the given system for causality, time invariance, linearity and stability, h(t) =$e^{x(t)}$

5.	Determine inverse Z- transform of X(z) = $\frac{1}{1-1.5z^{-1}+0.5z^{-2}}$ for (i) Causal system (ii) Anti-causal system
6.	Determine even and odd part of the signal x(n)=(-1, 4, -2,3,6)
7.	Perform circular convolution using DFT-IDFT $x_1(n) = \{2,1,2,1\}$, $x_2(n) = \{1,2,3,4\}$
8.	Perform linear convolution of the signals x(n)= {1,2,3,4}, h(n)= {1,2,1, -1} by matrix method.
9.	A linear shift invariant system is described by the difference equation y(n)- $\frac{3}{4}$ y(n-1)+ $\frac{1}{8}$ y(n-2)=x(n)+x(n-1) with y(-1)=0 and y(-2)=-1. Determine the natural response of the system (ii) forced response of the system
10.	a) Find the impulse response for the causal system y(n)-y(n-1)=x(n)+x(n-1) b) Find the response of the system to input $x(n)=2^n u(n)$
11.	Design a digital Butterworth low pass filter satisfying the following equation using bilinear transformation $0.7 \le \lvert H(e^{jw}) \rvert \le 1 \qquad 0 \le \omega \le 0.2\pi$ $\lvert H(e^{jw}) \rvert \le 0.3 \qquad 0.6\pi \le \omega \le \pi$
12.	Design an ideal low pass filter with frequency response $H_d(e^{jw}) = \begin{cases} 1, & \frac{-\pi}{2} \le w \le \frac{\pi}{2} \\ 0, & \frac{\pi}{2} \le w \le \pi \end{cases}$ Find H(z) for M=11
13.	Sketch the given signal: x(t) = 2u(t) + tu(t) – (t-1)u(t-1) – 3u(t-2)
14.	Explain any five properties of Z transform.
15.	A linear shift invariant system is described by the difference equation, $y(n) - \frac{3}{4}\, y(n-1) + \frac{1}{8}\, y(n-2) = x(n) + x(n-1)$ with y(-1) = 0 and y(-2) = -1. Find the natural response of the system.
16.	Compute circular convolution using DFT and IDFT $X_1(n)=\{0,1,2,3\}$ & $X_2(n)=\{4,5,6,7\}$
17.	A low filter is to be designed with the following desired frequency response; $H_d(e^{jw}) = \begin{cases} e^{-2jw} \\ 0 \end{cases} \quad \begin{matrix} \frac{-\Pi}{4} \le w \le \frac{\Pi}{4} \\ otherwise \end{matrix}$ Determine the filter coefficients h(n) if the window function is defined as $w(n) = \begin{cases} 1 \\ 0 \end{cases} \quad \begin{matrix} 0 \le n \le 4 \\ otherwise \end{matrix}$
18.	Determine the order of low pass Butterworth filter satisfying following specifications. f_p=0.1 Hz, α_p=0.5dB,

	f_s=0.15Hz, α_s=15dB, F=1Hz
19.	Define stable and unstable systems. Find the stability of the system for a system given below $y(t) = x(t)cos\omega_0 t$
20.	If the energy of the signal is $x(t) = e^{-5t}u(t)$ is $\frac{1}{10}$ Find time scale version of signal $x(2t)$
21.	If $x(t) = u(t-3) - u(t-5)$ & $h(t) = e^{-3t}u(t)$ Compute $y(t) = x(t) * h(t)$
22.	Finite sequence x(n) is defined as $x(n) = \{6, 3, -3, 0, -2, -2\}$ Find X(z)
23.	Find the 4-point DFT of the sequence x(n)= $\{1, j, -1, -j\}$ using matrix method.
24.	Discuss Rectangular, Hamming and Hanning windows used to design FIR filters.
25.	Design a digital low pass FIR filter for a following specification $H_d\,(e^{-j\omega}) = \begin{cases} e^{-j\omega\tau} & ; \ \lvert\omega\rvert \leq \omega_c \\ 0 & ; \ otherwise \end{cases}$ Using rectangular window of length =7 & ω_c=1rad/sample
26.	Compute DFT for the sequence x(n) = {1,2,3,4,4,3,2,1) using radix -2 DIF-FFT algorithm.
27.	Find the order of the IIR filter for a given specification using Bilinear Transformation method. $0.8 \leq \lvert H(e^{j\omega})\rvert \leq 1$ ---------- $0 \leq \omega \leq 0.2\pi$ $\lvert H(e^{j\omega})\rvert \leq 0.2$ ---------- $0.6\pi \leq \omega \leq \pi$
28.	Find the trigonometric fourier series expansion of the waveform 
29.	Obtain the fourier series for the waveform shown in fig below

x(t)
A
t
-2π
-π
0
π
2π
-A