

University of Mumbai
Examinations Summer 2022

Time: 2 hour 30 minutes

Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	Which of the following applies to periodic continuous time signals:
Option A:	$x(n) = x(N + n)$
Option B:	$x(t) = e^{st}$
Option C:	$x(t) = x(t + T_0)$
Option D:	$X(Z) = (z - 1) X(Z)$
2.	The energy of the signal, $x(n) = u(n)$ is:
Option A:	1 J
Option B:	$\frac{1}{2}$ J
Option C:	∞ J
Option D:	0 J
3	If $x_1(n) = \{1,2,3\}$ and $x_2(n) = \{1,1,1\}$, then what is the convolution sequence of the given two signals?
Option A:	$\{1,2,3,1,1\}$
Option B:	$\{1,2,3,4,5\}$
Option C:	$\{1,3,5,6,2\}$
Option D:	$\{1,3,6,5,3\}$
4.	If $L\{x(t)\} = X(s)$ then $L\{x(at)\}$ will be
Option A:	$ a X\left(\frac{s}{a}\right)$
Option B:	$\frac{1}{ a } X\left(\frac{s}{a}\right)$
Option C:	$ a X\left(\frac{a}{s}\right)$
Option D:	$\frac{1}{ a } X\left(\frac{a}{s}\right)$
5.	Two Cascade connected discrete time systems with impulse responses $h_1(n)$ and $h_2(n)$ can be replaced by a single equivalent discrete time system with impulse response,
Option A:	$h_1(n) * h_2(n)$
Option B:	$h_1(n) + h_2(n)$
Option C:	$h_1(n) - h_2(n)$
Option D:	$h_1(n)$
6.	Laplace Transform of the signal $x(t) = u(t-1)$
Option A:	$1/s-1$
Option B:	e^{-s}/s
Option C:	$e^{-s}/(s-1)$
Option D:	$(s-1)$

7.	If $Z\{x(n)\} = X(z)$ then
Option A:	$Z\{x(-n)\} = -X(z)$
Option B:	$Z\{x(-n)\} = X(-z)$
Option C:	$Z\{x(-n)\} = -X(z^{-1})$
Option D:	$Z\{x(-n)\} = X(z^{-1})$
8.	$y(t) = x(t/2)$ represents a
Option A:	compressed signal
Option B:	expanded signal
Option C:	time- shifted signal
Option D:	amplitude scaled signal by the factor of 2
9	Fourier Transform of DT unit impulse signal is
Option A:	-1
Option B:	1
Option C:	0
Option D:	Undefined
10	For a stable system which of the following is correct?
Option A:	$ z < 1$
Option B:	$ z = 1$
Option C:	$ z > 1$
Option D:	$ z \neq 1$

Q2. (20 Marks)	Solve any Four out of Six	(5 marks each)
A	Function $x(t)$ is shown in figure. Draw even and odd parts of $x(t)$	
B	Determine following signal is periodic or not. If periodic, determine the fundamental period	$10 \sin(12\pi t) + 4 \sin(18\pi t)$
C	Determine Laplace transform and ROC of signal	$x(t) = e^{2t} u(t) - e^{4t} u(-t) + 6t^3 - 3\sin 5t$
D	Prove the shifting property of Z transform	
E	Determine whether the system described by $y(t) = x(0.5t)$	i) Linear ii) Time invariant
F	Perform convolution using graphical method	$x(t) = t u(t)$ $h(t) = e^{-t}$ for $t \geq 0$

Q3 (20 Marks)	Solve any Two Questions out of Three (10 marks each)
A	For a CT signal $x(t) = 8 \cos(200\pi t)$ Find 1. Nyquist rate 2. If $f_s = 120$ Hz, write the equation for DT signal $x(n)$ 3. If $f_s = 250$ Hz, write the equation for DT signal. Comment on result obtained in 2 & 3.
B	A continuous time LTI system is represented by differential equation $\frac{d^2y(t)}{dt^2} + 3 \frac{dy(t)}{dt} + 2y(t) = x(t)$ i) Determine transfer function ii) Obtain step response iii) Obtain impulse response
C	Obtain inverse Laplace transform of $x(s) = \frac{3s+7}{(s+1)(s-3)}$ for ROC $\text{Re}(s) > 3$, $\text{Re}(s) < -1$ & $-1 < \text{Re}(s) < 3$

Q4. (20 Marks)	Solve any Two Questions out of Three (10 marks each)
A	Solve any Two 5 marks each
i.	Obtain Discrete time Fourier transform and magnitude plot of $h(n) = \{0, 1, 1, 1\}$
ii.	Determine the spectra of periodic signal (Discrete time Fourier series) $X(n) = \{1, 1, 1, 0\}$ with period $N=4$
iii.	Obtain the continuous time Fourier transform of 1) Unit step and 2) Unit impulse
B	Solve any One 10 marks each
i.	Find impulse response for all possible ROC conditions for a transfer function given by $x(Z) = \frac{Z(Z^2 - 4Z + 5)}{(Z-1)(Z-2)(Z-3)}$
ii.	Obtain continuous time Fourier series of saw tooth wave shown in figure 