University of Mumbai

Examinations Summer 2022

Time: 2 hour 30 minutes Max. Marks: 80

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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:	$x(t) = x(t+T0)$
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:	½ J
Option C:	∞ J
Option D:	0 J
3	If x1(n) = {1,2,3} and x2(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:	$\lvert a\rvert\, X(\frac{s}{a})$
Option B:	$\frac{1}{\lvert a\rvert}\, X(\frac{s}{a})$
Option C:	$\lvert a\rvert\, X(\frac{a}{s})$
Option D:	$\frac{1}{\lvert a\rvert}\, X(\frac{a}{s})$
5.	Two Cascade connected discrete time systems with impulse responses h1(n) and h2(n) can be replaced by a single equivalent discrete time system with impulse response,
Option A:	h1(n) * h2(n)
Option B:	h1(n) + h2(n)
Option C:	h1(n) - h2(n)
Option D:	h1(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)

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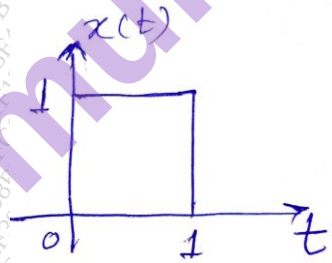
7.	If $Z\{x(n)\} = X(z)$ then
Option A:	$Z\{x(-n)\} = -X(z)$
Option B:	$Z\{x(-n)\} = X(-z)$
Option C:	$Z\{x(-n)\} = -X(z^{-1})$
Option D:	$Z\{x(-n)\} = X(z^{-1})$
8.	y(t) = x(t/2) represents a
Option A:	compressed signal
Option B:	expanded signal
Option C:	time- shifted signal
Option D:	amplitude scaled 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 $t \geq 0$

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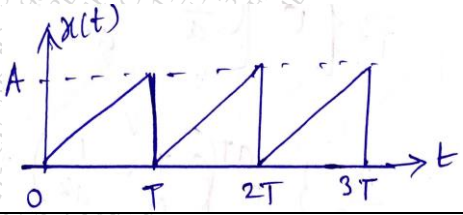
Q3 (20 Marks)	Solve any Two Questions out of Three (10 marks each)
A	For a CT signal x(t) = 8 cos (200πt) Find 1. Nyquist rate 2. If fs = 120 Hz , write the equation for DT signal x(n) 3. If fs = 250 Hz, write the equation for DT signal. Comment on result obtained in 2 & 3.
B	A continuous time LTI system 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 $R_{e(s)}>3$, $R_{e(s)} < -1$ & $-1< R_{e(s)}<3$

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 

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