University of Mumbai

Examination Summer 2022

Program: **EXTC**

Curriculum Scheme: Rev 2019

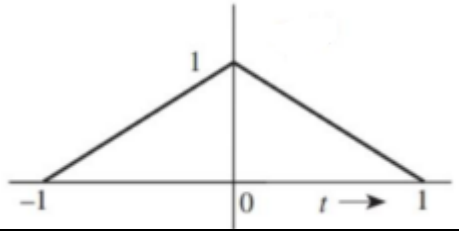
Examination: SE Semester IV

Paper Code: 40824 Course Code: ECC404 and Course Name: Signals and Systems

Time: 2 hours and 30 minutes Max. Marks: 80

Q1(20 Marks)	**Choose the correct option for the following questions. All the Questions are compulsory and carry equal marks**
1.	A system is described by differential equation $\frac{d^2y}{dt^2} + 3\frac{dy}{dt} + 2y(t) = x(t)$ is initially at rest. For input x(t) = 2u(t) the output y(t) is
Option A:	$(1 - 2e^{-t} - e^{-2t})u(t)$
Option B:	$(1 - 2e^{-t} - 2e^{-2t})u(t)$
Option C:	$(0.5 + e^{-t} + 1.5e^{-2t})u(t)$
Option D:	$(0.5 + 2e^{-t} + 2e^{-2t})u(t)$
2.	The power in the signal (t) = 8cos (20πt – (π/2)) + 4sin (15πt) is equal to _____
Option A:	40
Option B:	42
Option C:	41
Option D:	82
3.	Find the Z-transform of y(n) = x(n+2)u(n)
Option A:	z^2 X(z) – z^2 x(0) – zx(1)
Option B:	z^2 X(z) + z^2 x(0) – zx(1)
Option C:	z^2 X(z) – z^2 x(0) + zx(1)
Option D:	z^2 X(z) + z^2 x(0) + zx(1)
4.	Find the Z-transform of x(n) = n[a^n u(n)].
Option A:	1 / (z (z-a))
Option B:	az / (z(z-a))
Option C:	az / (z(z+a))
Option D:	a / (z $(z-a)^2$)
5.	If two LTI systems with impulse response h1(t) and h2(t) and are connected in parallel then output is given by _____
Option A:	y(t) = x(t) *(h1(t) + h2(t))
Option B:	y(t) = x(t) + (h1(t) + h2(t))
Option C:	y(t) = x(t) * (h1(t) h2(t))
Option D:	y(t) = (x(t) * h1(t)) + h2(t)
6.	Laplace transform of e^{-2t} u(t)
Option A:	1 / (S+2)
Option B:	S / (S+2)
Option C:	1 / (S-2)

Option D:	S / (S-2)
7.	Inverse Laplace transform of a constant 5
Option A:	5
Option B:	5 δ (t)
Option C:	5 e^{t}
Option D:	5 e^{-t}
8.	RoC of finite duration left sided DT signal
Option A:	Right side of imaginary axis
Option B:	Left side of imaginary axis
Option C:	Entire Z-plane except Z = 0
Option D:	Entire Z-plane except Z = ∞
9.	The discrete time Fourier Transform of x[n] = {2, 1, 2}
Option A:	$1/(1+4\cos\omega)\, e^{-j\omega}$
Option B:	$(2+4\cos\omega)\, e^{-j\omega}$
Option C:	$(1+4\cos\omega)\, e^{-j\omega}$
Option D:	$(e^{-j\omega}+4\cos\omega)\, e^{-j\omega}$
10.	The ROC of the signal $x[n]= a^n$ for $-5 < n < 5$
Option A:	Entire z-plane
Option B:	Entire z-plane except z=0 and z=∞
Option C:	Entire z-plane except z=0
Option D:	Entire z-plane except z=∞

Q2 (20 Marks)	
A	**Solve any Two** **5 marks each**
i.	Find the Laplace transform of $x(t) = 5\sin\omega_0 t\, u(t)$ and sketch the RoC
ii.	If x[n] = [4 2 1 3], Sketch x[n], x[-n], -x[-n], x[-2n] and x[n/2]
iii.	Verify the given signals are periodic or not. If periodic, determine the period and frequency of each signal $x_1(t) = \cos 50\pi t$, $x_2(t) = \cos 100\pi t$, $x_3(t) = x_1(t) + x_2(t)$ and $x_4(t) = x_1(t)\ x_2(t)$
B	**Solve any One** **10 marks each**
i.	Perform convolution of the causal signals, using Laplace transform. **$x_1(t) = \cos t\, u(t)$, $x_2(t) = t\, u(t)$**
ii.	Find the Fourier transform of following signal and plot magnitude and phase spectrum 

Q3 (20 Marks)	
A	**Solve any Two** **5 marks each**
i.	Input to a continuous time system is x(t) = 3, 0 < t < 3 and zero

	elsewhere. Sketch x(t+3), x(-t+3), x(-t-3), x(3t) and x(t/3)
ii.	Find the IZT of $X[z] = 3+2z^{-1}+z^{-2} / 1-3z^{-1}+2z^{-2}$ using partial fraction method
iii.	Determine the even and odd parts of the signals. x[n] = {4, -4, 2, -2} (Please note - the arrow is under -4) ⇑
B	**Solve any One** **10 marks each**
i.	Find inverse Fourier transform of $X(j\omega) = \frac{(j\omega+3)}{(j\omega+4)(j\omega+2)^2}$
ii.	Using the differentiation in frequency property, find the Fourier transform of $y(t)=t\,x(t)$ where $x(t)= e^{-bt}\,u(t)$.

Q4 (20 Marks)	
A	**Solve any Two** **5 marks each**
i.	Using canonical structure, realize the following IIR system with I/O relation y[n] = x[n] +2x[n-1] +3y[n-1]
ii.	Realize the following FIR system with h[n] = [4,0,2,-3,-4]
iii.	Find x(t) * h(t) using LT and ILT where x(t) = u(t) and h(t) = δ (t-3)
B	**Solve any One** **10 marks each**
i.	Impulse response of a LTI system is given as $h(t) = e^{-4t}\,u(t)$. Find H(s), sketch the RoC and verify the stability of the system
ii.	A causal DT LTI system is described by $y(n)-(5/6)y(n-1)+(1/6)y(n-2)=x(n)$, where $x(n)$ and $y(n)$ are the input and output of the system. Find the response $y(n)$ for the input $x(n)=(1/4)^n\,u(n)$.

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