

# University of Mumbai

## Examination June 2021

Examinations Commencing from 1<sup>st</sup> June 2021

Program: BE Electronics & Telecommunication Engineering

Curriculum Scheme: Rev2020

Examination: SE Semester IV

Course Code: ECC404 and Course Name: Signal and systems

Time: 2 hour

Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	The step function $u(t)$ is integral of _____ with respect to time $t$ .
Option A:	Ramp function
Option B:	Impulse function
Option C:	Sinusoidal function
Option D:	Exponential function
2.	An example of a discrete set of information/system is
Option A:	the trajectory of the Sun
Option B:	Data on CD
Option C:	universe time scale
Option D:	movement of water through a pipe
3.	A system is said to be defined as non causal, when
Option A:	the output at the present depends on the input at an earlier time
Option B:	the output at the present does not depend on the factor of time at all
Option C:	the output at the present depends on the input at the current time
Option D:	the output at the present depends on the input at a time instant in future
4.	Zero-input response is also known as
Option A:	zero-state response
Option B:	Natural response
Option C:	state-input response
Option D:	Forced response
5.	Which of the following systems is memory less?
Option A:	$y(t) = 2x(t) + \frac{d}{dx} x(t)$
Option B:	$y(t) = 2x^2(t) + \frac{d}{dx} x(t)$
Option C:	$y(t) = \int x(t) dt$
Option D:	$y(t) = 2x^2(t)$
6.	An example for non-causal system is
Option A:	Amplifier
Option B:	Oscillator
Option C:	Rectifier
Option D:	Does not exist

7.	Find the Laplace transform of $\delta(t)$
Option A:	1
Option B:	0
Option C:	$\infty$
Option D:	2
8.	Find the Laplace transform of $e^{-at} \sin \omega t u(t)$
Option A:	$\frac{s+a}{(s+a)^2 + \omega^2}$
Option B:	$\frac{s+a}{(s+a)^2 - \omega^2}$
Option C:	$\frac{\omega}{(s+a)^2 + \omega^2}$
Option D:	$\frac{\omega}{(s+a)^2 - \omega^2}$
9.	Find $x(\infty)$ if $X(s)$ is given by $\frac{s-2}{s(s+4)}$
Option A:	1
Option B:	-1
Option C:	0.5
Option D:	-0.5
10.	The Laplace transform of the function $e^{4t} + 5$ is
Option A:	$\frac{1}{s+4} + \frac{5}{s}$
Option B:	$\frac{1}{s-4} + \frac{5}{s}$
Option C:	$\frac{1}{s-4} - \frac{5}{s}$
Option D:	$\frac{1}{s+4} - \frac{5}{s}$
11.	The Laplace transform of the function $\cos(2t) + 7\sin(2t)$ is
Option A:	$\frac{s-14}{s^2-14}$
Option B:	$\frac{s+14}{s^2-4}$
Option C:	$\frac{s-14}{s^2+4}$
Option D:	$\frac{s+14}{s^2+4}$
12.	Find the Z-transform of $a^n u(n)$ ; $a > 0$ .
Option A:	$\frac{z}{z-a}$
Option B:	$\frac{z}{z+a}$
Option C:	$\frac{1}{1-az}$
Option D:	$\frac{1}{1+az}$

13.	Find the Z-transform of the causal sequence $x(n) = \{1,0,-2,3,5,4\}$ . (1 as the reference variable)
Option A:	$1 - 2z^{-2} + 3z^{-3} + 5z^{-4} + 4z^{-5}$
Option B:	$1 - 2z^2 + 3z^3 + 5z^4 + 4z^5$
Option C:	$z^{-1} - 2z^2 + 3z^3 + 5z^4 + 4z^5$
Option D:	$z - 2z^3 + 3z^4 + 5z^5 + 4z^6$
14.	Find the Z-transform of $x(n) = u(-n)$
Option A:	$\frac{1}{z-1}$
Option B:	$\frac{1}{z+1}$
Option C:	$\frac{1}{1-z}$
Option D:	$-\frac{1}{z+1}$
15.	The z-transform of $x[n] = \{1,0,-1,0,1,-1\}$ (1st 1 as the reference variable) is
Option A:	$1 + 2z^{-2} - 4z^{-4} + 5z^{-5}$
Option B:	$1 - z^{-2} + z^{-4} - z^{-5}$
Option C:	$1 - 2z^2 + 4z^4 - 5z^5$
Option D:	$1 - z^2 + z^4 - z^5$
16.	Find $x(\infty)$ if $X(z) = \frac{z+1}{(z-0.6)^2}$
Option A:	1
Option B:	0
Option C:	$\infty$
Option D:	0.6
17.	What is the set of all values of $z$ for which $X(z)$ attains a finite value?
Option A:	Radius of convergence
Option B:	Radius of divergence
Option C:	Feasible solution
Option D:	Convergence and Divergence
18.	Find the Fourier transform of $j/\pi t$
Option A:	$\text{sinc}(\omega)$
Option B:	$\text{sa}(\omega)$
Option C:	$\delta(\omega)$
Option D:	$\text{sgn}(\omega)$
19.	Find the Fourier transform of $u(-t)$ .
Option A:	$\pi\delta(\omega) + 1/\omega$
Option B:	$\pi\delta(\omega) + 1/j\omega$
Option C:	$\pi\delta(\omega) - 1/j\omega$
Option D:	$\delta(\omega) + 1/j\omega$
20.	Find the convolution of the signals $x_1(t) = e^{-2t} u(t)$ and $x_2(t) = e^{-3t} u(t)$ .
Option A:	$e^{-2t} u(t) - e^{-3t} u(t)$

Option B:	$e^{-2t} u(t) + e^{-3t} u(t)$
Option C:	$e^{2t} u(t) - e^{3t} u(t)$
Option D:	$e^{2t} u(t) - e^{-3t} u(t)$

<b>Q2</b>	
A	<b>Solve any Two</b> <span style="float: right;"><b>5 marks each</b></span>
i.	Using Laplace transform, determine the natural response of the system described by the equation, $\frac{d^2y(t)}{dt^2} + 6 \frac{dy(t)}{dt} + 5y(t) = \frac{dx(t)}{dt} + 4x(t) ; y(0) = 1 ; \left. \frac{dy(t)}{dt} \right _{t=0} = -2$
ii.	Find the impulse response and step response of CT systems governed by the following transfer functions: $H(s) = (s+3)/(s^2 + 6s + 8)$
iii.	Determine the Inverse Z-Transform of the following function: $X(z) = \frac{1}{1 - 1.5z^{-1} + 0.5z^{-2}}$
B	<b>Solve any One</b> <span style="float: right;"><b>10 marks each</b></span>
i.	Relation of ESD, PSD with auto-correlation
ii.	Find Laplace transform of $d/dt (\sin(t) u(t))$

<b>Q3</b>	
A	<b>Solve any Two</b> <span style="float: right;"><b>5 marks each</b></span>
i.	Determine if the system given by $y(t) = t x(t)$ is memoryless, causal, linear, time invariant and stable.
ii.	Determine if the following signal is periodic. If yes, find the fundamental period. $X(t) = 5\cos 4\pi t + 3\sin (8\pi t)$
iii.	Perform convolution on following signals by graphical method. $x(t) = e^{-3t} u(t)$ and $h(t) = t u(t)$
B	<b>Solve any One</b> <span style="float: right;"><b>10 marks each</b></span>
i.	Determine DTFS for the sequence $x(n) = \cos^2 ((\pi/8)n)$
ii.	State and Prove Parseval's Theorem with respect to DTFT.