Reg. No. | | | | | | | | | | | | | | |

B.E / B.TECH. DEGREE EXAMINATIONS, MAY 2023

Fourth Semester

EC18402 – SIGNALS AND SYSTEMS

(Electronics and Communication Engineering)

(Regulation 2018A)

TIME:3 HOURS **MAX. MARKS: 100**

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Classify signals and systems based on their properties.	3
CO 2	Infer the spectral characteristics of continuous time signals by applying Fourier and Laplace transform.	4
CO 3	Use the principles of Fourier transform and Z transform to analyze the characteristics of discrete time signals.	4
CO 4	Determine the response of continuous and discrete time LTI systems.	3
CO 5	Illustrate the process of sampling and the effects of under and over sampling.	4

PART- A (10x2=20Marks)

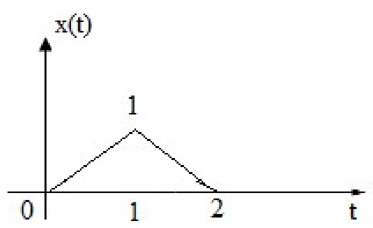
(Answer all Questions)

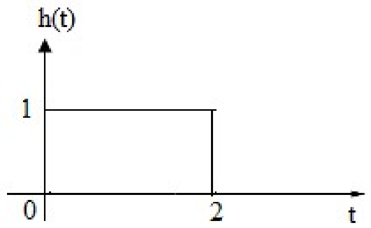
		CO	RBT LEVEL
1.	Give the relation between unit impulse function $\boldsymbol{\delta(t)}$ and unit step function $\boldsymbol{u(t)}$.	1	2
2.	Sketch the signal, $\boldsymbol{x[n] = u[n-2] - u[n+2]}$.	1	3
3.	Find the inverse Fourier transform of $X(j\Omega) = \frac{e^{-j2\Omega}}{j\Omega+2}$	2	3
4.	Determine the Laplace transform of $\boldsymbol{x[t] = t\, u(t-2)}$ using suitable property.	2	3
5.	Check whether the system $\boldsymbol{h(t) = e^{4t}\, u(-t)}$ is stable or not.	4	3
6.	Given $\boldsymbol{x[n] = u[-n-1]}$, find $\mathbf{X}(\boldsymbol{e^{j\omega}})$.	3	3
7.	State the need for sampling.	5	2
8.	Find the initial value x (0) of the following z domain function. $$\boldsymbol{X(z) = \frac{2}{(1+z^{-1})^2(1-z^{-1})}}$$	3	3
9.	Consider an LTI system with impulse response $\boldsymbol{h[n] = \delta[n-n_0]}$ for an input $\boldsymbol{x[n]}$, find the response, $\boldsymbol{Y(e^{j\omega})}$.	4	3
10.	Compare recursive and non recursive system.	4	2

Q. Code: 928880

PART- B (5x 14=70Marks)

			Marks	CO	RBT LEVEL
11. (a)		Determine whether the given signals are power or energy or neither. $\boldsymbol{a)\ x(t) = e^{j(2t+(\frac{\pi}{4}))}}$ $\boldsymbol{b)\ x[n] = \begin{cases} \left(\frac{1}{2}\right)^n & n \geq 0 \\ (3)^n & n < 0 \end{cases}}$	(14)	1	3
		(OR)			
(b)		Determine whether the following systems are Static or Dynamic, Linear or Nonlinear, Time variant or Invariant, Causal or Non-causal. a) $\boldsymbol{y[n] = x[n+2] + x[-n-2]}$ b) $\boldsymbol{y(t) = tx(2t) + x(t-3)}$	(14)	1	3
12. (a)	**(i)**	Compute convolution using Fourier transform for $\boldsymbol{x_1(t) = e^{-2t}u(t)}$ and $\boldsymbol{x_2(t) = e^{-6t}u(t)}$.	(10)	2	3
	(ii)	Compute the energy of a signal x(t) using Parseval's theorem.	(4)	2	3
		(OR)			
(b)	**(i)**	Find the Inverse Laplace transform for $X(s) = \frac{(3s+7)}{(s^2-2s-3)}$ If (i) Re(s) >3 (ii) Re(s) < -1 (iii) 3> Re(s) > -1	(10)	2	3
	(ii)	Find the Laplace transform of signal $\boldsymbol{x(t) = te^{-2t}u(t)}$ using appropriate property.	(4)	2	3
13. (a)		Using Fourier transform, find the impulse response and response of the system described by the equation, $$\boldsymbol{\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 6\,y(t) = 2\,x(t); \qquad if\ x(t) = u(t)}$$	(14)	4	3
		(OR)			
(b)		Find the convolution of the given signals using graphical method	(14)	4	3





14. (a) **(i)** Consider an analog signal $x(t) = 2\cos 2000\pi t + 5\sin 4000\pi t$, determine the Nyquist sampling rate and sketch the discrete time signal. **(6)** 5 3

(ii) Determine the Fourier transform of the following signal. **(8)** 4 3

$$x[n] = \left(\frac{1}{2}\right)^{n-2} u[n-1]$$

(OR)

(b) **(i)** Consider a signal, $x(t) = e^{-t}$; $0 \le t \le 2$, sample the signal with a sampling period T = 0.2s and sketch the discrete time signal. **(6)** 5 3

(ii) Determine the inverse Z transform of the function, **(8)** 4 3

$$X(z) = \frac{3 - \frac{5}{6}z^{-1}}{\left(1 - \frac{1}{4}z^{-1}\right)\left(1 - \frac{1}{3}z^{-1}\right)}$$

ROC: |z| > 1/3; ii) ROC: |z| < ¼; iii) ROC: 1/4 < |z| < 1/3

15. (a) **(i)** A causal system is represented by the following difference equation, **(8)** 3 3

$$y(n) + \frac{1}{4}y(n-1) = x(n) + \frac{1}{2}x(n-1)$$

Find the frequency response and the impulse response of the system.

(ii) Determine the convolution sum of two sequences **(6)** 3 3

$$x(n) = \{1, 2, 3, 2\} \; ; \; h(n) = \{1, 2, 2\}$$

(OR)

(b) **(i)** A system is represented by the following difference equation **(14)** 3 3

$$y[n] = 0.8y[n-1] - 0.12y[n-2] + x[n]$$

Determine (i) the system function

(ii) impulse response for the following conditions

(a) the system is stable

(b) the system is causal

(c) the system is anticausal

PART- C (1x 10=10Marks)

(Q.No.16 is compulsory)

		Marks	CO	RBT LEVEL
16.	Determine whether or not each of the following signals is periodic. If periodic, specify its fundamental period.	**(10)**	1	3

(i) $x(t) = 3\cos(4t + \frac{\pi}{3})$

(ii) $x[n] = e^{j2\pi n/3} + e^{j3\pi n/4}$

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