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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S4 (R,S) / S4 (PT) (R,S) Examination June 2023 (2019 Scheme)

Course Code: ECT204

Course Name: SIGNALS AND SYSTEMS

Max. Marks: 100 Duration: 3 Hours

PART A

(Answer all questions; each question carries 3 marks) Marks

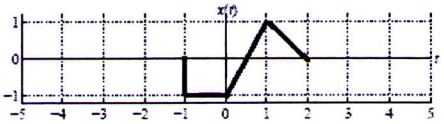
1	Sketch the following waveform. **x(t) = t.[u(t)-u(t-4)]**	3
2	Check for shift invariance & linearity the systems represented by $y(t) = x^2(t-1)$	3
3	State and prove the time scaling property of CTFT.	3
4	Determine LT of $\mathbf{x(t) = e^{-4t}\,u(t) - e^{-4(t-1)}\,u(t)}$	3
5	Explain the role of Laplace Transform in determining the system function.	3
6	What should be the minimum sampling frequency for the correct sampling of the signal $\mathbf{x(t) = 4\sin(2\pi t) + \cos(5\pi t+0.1) + \cos(\pi t)}$	3
7	Determine DTFT of $x(t) = \partial(n+3) - \partial(n-3)$	3
8	State and Prove the Convolution property of DTFS	3
9	Find the Z transform of $x(n) = r^n \sin \omega_n\, u(n)$	3
10	What is the final value of x(n), if $\mathbf{X(Z) = \frac{z^2}{(z-1)(z-0.2)}}$	3

PART B

(Answer one full question from each module, each question carries 14 marks)

Module -1

11 a) Given x(t). Sketch a . x(-t), b. x(t+2),c. x(t-1), d. x(t/2), e. x(2t) . 10



b) Check whether the signals given are periodic or not. If periodic, Find the 4

fundamental periods.

a. x(t)= sin2t+ cos 3πt

b. sin2πt+ cos √2πt

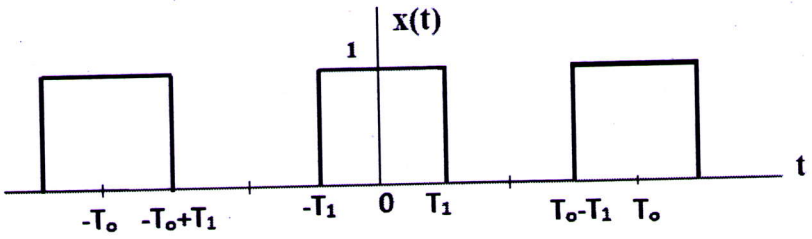
12 a) Find the response of an LTI system whose input x(t) and impulse response h(t) are given 8

$$x(t) = u(t)$$
$$h(t) = e^{-at}u(t)$$

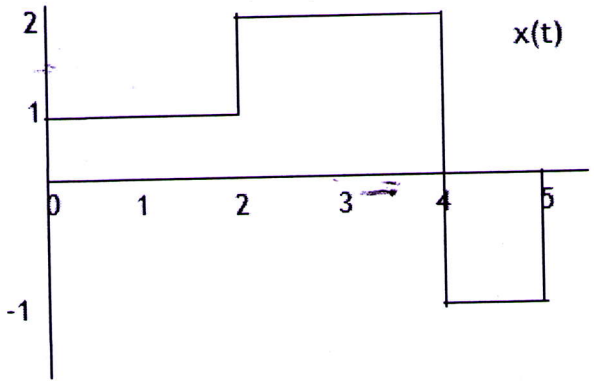
b) What is the output y(n) for a LTI system with impulse response h(n)=(1,2,1) for an input sequence x(n)=(1,3,3,2,1). 6

Module -2

13 a) Find the complex exponential Fourier series for the function shown for T_o=4,8. 8



b) Determine FT of the signal given below. 6



14 a) (i) Using the frequency shifting property find FT of $\mathbf{x(t)= e^{j2t}u(t)}$ 8

(ii) Using Time reversal property find FT of **x(t) = u(-t)**

b) Determine the Laplace Transform and express the ROC of the signal 6

$x(t) = e^{-t}u(t) + e^{-2t}u(t)$

Module -3

15 a) A certain continuous LTI system is described by the following differential equation. $\frac{dy(t)}{dt} + 5\,y(t) = x(t)$ 6

Determine y(t) using Fourier Transform for the following inputs.

(i) $x(t) = e^{-2t}\,u(t)$

(ii) $x(t) = \partial(t)$

b) Using convolution property of the Laplace Transform determine the system response for the following input x(t) and impulse response h(t) 8

(i) **$x(t) = e^{-2t}\,u(t)$, $h(t) = e^{-3t}\,u(t)$**

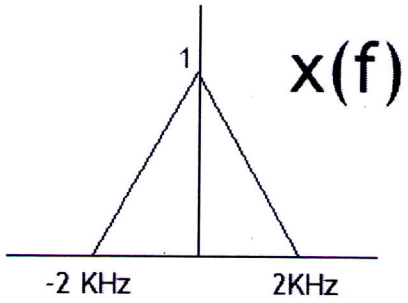
(ii) $x(t) = e^{-2t}\,u(t)$, $h(t) = (1+e^{-3t})\,u(t)$

16 a) Find the Nyquist rate of the signal 6

(i) $x(t) = \sin 20\pi t - 2\cos 100\pi t$

(ii) $x(t) = \cos 150\pi t . \sin 100\pi t$

b) Consider the continuous time band-limited signal x(t) with a spectrum x(f) as shown in figure above. Sketch the spectrum of the discrete time signals $x_1[n]$ and $x_2[n]$ obtained from x(t) by sampling at 5 KHz and 3 KHz respectively. 8



Module -4

17 a) A signal x[n] has the DTFT, $\mathbf{X(\omega)} = \frac{1}{1-ae^{-j\omega}}$. Find x[n]. Determine the DTFT of 8

(i) x[n+1]

(ii) x[n]*x[-n] , * stands for convolution

b) Find the DTFT of the discrete time signal **$x(n) = a^{|n|}$, $-1 < a < 1$** 6

18 a) Determine the Discrete Time Fourier series representation for the sequences 8

(i) $x[n] = \frac{\cos\pi}{3}\,n + \frac{\sin\pi}{4}\,n$

(ii) $x[n] = \cos^2[\frac{\pi}{8}\,n]$

b) Find the impulse response of the system using DTFT, described by the difference equation. 6

$y[n] = x[n] + \frac{1}{2}x[n-1] + \frac{1}{2}y[n-1]$

Module -5

19 a) Determine z transform of the function $x(n) = (n+0.5)(1/3)^n u(n)$ 6

b) Obtain the transfer function and impulse response for a stable and causal system with difference equation 8

$$y[n] + \frac{1}{6}y[n-1] - \frac{1}{6}y[n-2] = 3x[n] - \frac{1}{6}x[n-1]$$

20 a) Determine inverse Z transform of 8

(i) $X(z) = \frac{0.5z}{(z-1)(z-0.5)}$

(ii) $X(z) = \frac{z}{z^2-z+1}$

b) Draw the pole zero plot and comment on the stability of the system given by 6

$x(n) = (1/4)^n u(n) + (-1/2)^n u(n)$

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