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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S4 (S, FE) / S4 (PT) (S, FE) / S4 (WP) (S) Examination December 2024 (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	Define and sketch three elementary signals in both continuous and discrete time.	3
2	Find the convolution of x(n) = {1, 2, 3, 4, 5} with h(n) = {1, 2, 3, 3, 2, 1}.	3
3	State the Dirichlet's conditions for the convergence of Fourier series.	3
4	Find the Fourier transform of $x(t) = e^{-2t}u(t) + e^{3t}u(-t)$.	3
5	Define transfer function of a continuous time LTI system. Explain the significance of poles and zeros .	3
6	Find the frequency response of an LTI system having an impulse response $h(t) = \delta(t-1) + \delta(t-2)$. Check whether the given system is causal or not	3
7	Find the power of the following signal using Parseval's theorem. $$x[n] = cos\frac{\pi n}{5} + \sin\frac{\pi n}{6}$$	3
8	State any three properties of Discrete Time Fourier transform (DTFT).	3
9	What is the relation between Z Transform and DTFT? With suitable example explain the Z transform and ROC of right, left and double-sided signals.	3
10	Find the ZT of $x[n] = (\frac{1}{3})^{n-1}u[n-1]$. Plot the ROC	3

PART B

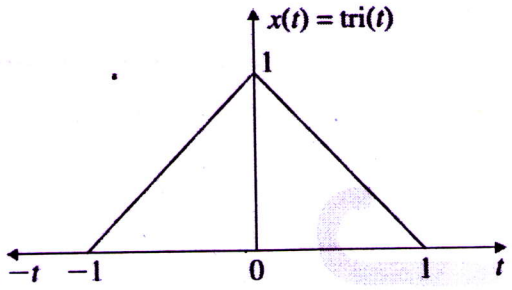
(Answer one full question from each module, each question carries 14 marks)

Module -1

11	a)	Consider the triangular wave form x(t) shown in Fig. Sketch and label carefully each of the following signals:	10

(i) $x(2t+3)$ (iii) $x(\frac{t+3}{2})$

(ii) $x\left(\frac{t}{2}-3\right)$ (iv) $x(-2t+3)$



b) Consider the following continuous time signal: x(t) = 2 cos 3πt + 7 cos 9t 4
Find the periodicity of the signal. If it is periodic find the period

12 a) Find the convolution of x[n] = u[n] and h[n] =u [n]. Plot the result 8

b) Check whether the following systems are time invariant or not: 6

(i) $y(t) = t\,x(t)$

(ii) $y(t) = \cos x(t)$

(iii) $y(t) = x(t)\cos x(t)$

Module -2

13 a) State and prove multiplication property of Fourier transform 6

b) Find the Fourier transform of the following time functions and plot their Fourier spectra (amplitude) 8

(i) $x(t) = sgn(t)$

(ii) $x(t) = e^{-a|t|}\ ;\ a > 0$

14 a) Consider the following function. $X(s) = \frac{10}{(S+4)(S-2)}$. Find x(t) if the ROC is 7

(iii) $Real(S) > 2$

(iv) $Real(S) < -4$

(v) $-4 < Real(S) < 2$

b) Find the trigonometric series representation of the signal whose mathematical description is given as 7

$$x(t) = \begin{cases} 1 & 0 \le t < \frac{T}{2} \\ 0 & \frac{T}{2} \le t \le T \end{cases} \text{ and } x(t+T) = x(t)$$

Module -3

15 a) Consider a linear time invariant causal system with the following differential equation with zero initial conditions for the input and output. Find the transfer function and impulse response of the system. 7

$$\frac{d^2y(t)}{dt^2} + 4\frac{d\,y(t)}{dt} + 3y(t) = \frac{dx(t)}{dt} + 2x(t)$$

b) Find the frequency response of a system with impulse response $h(t) = \frac{1}{1+jt}$ 7

16 a) A system has the transfer function $H(s) = \frac{2}{S+3} + \frac{1}{S-2}$. Find the impulse response assuming 7

(i) The system is stable

(ii) The system is causal

b) State sampling theorem of band limited signal. Determine the Nyquist rate and Nyquist interval for the sampling of a continuous signal x(t) . 7

$x(t) = \cos(\pi/2)t + 3\sin(2\pi/3)t + \sin 4\pi t$

Module -4

17 a) Use Fourier transform to find the output of the system whose impulse response 8

$h[n] = (\frac{1}{3})^n\, u[n]$and the input to the system is $x[n] = (\frac{1}{2})^n\, u[n]$

b) Determine the Discrete Time Fourier Series (DTFS) coefficients of the signals 6

$$x[n] = \sin\left(\frac{\pi}{4}\right)n$$

18 a) Find the DTFT of the two discrete time signals 7

(i) $x[n] = -a^n\, u[-n-1]$ and

(ii) $x[n] = a^{|n|}$, a < 1

b Find the DTFT of the discrete time signals 7

$(i)x[n] = \cos\Omega_0 n$

(ii) $x[n] = [1,2,3,4]$

Module -5

19 a) Find the system transfer function H(z) of the following first-order difference equation 6

$y[n] - 2\,y[n-1] = x[n] + x[n-1]$

b) Using partial function, find the inverse z-transform 8

$$H(Z) = \frac{(1 - z^{-1} + z^{-2})}{(1 - z^{-1})(1 - 2z^{-1})(1 - 4z^{-1})} \quad ROC: 2 < |z| < 4$$

20 a) Find the ZT of the following discrete time signals and plot the ROC 8

(i) $x[n] = -a^n\, u[-n-1]$ $(ii)\, x[n] = 3^{n-1}\, u[n] - (-3)^{n-1}u[n]$

b) State and prove convolution property of ZT with ROC 6

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