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Reg No.:_____   Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
B.Tech Degree S6 (S, FE) Examination January 2024 (2019 Scheme)

Course Code: RAT306

Course Name: SIGNALS AND SYSTEMS

Max. Marks: 100   Duration: 3 Hours

PART A
Answer all questions, each carries 3 marks.   Marks

1	Find the even and odd component of the signal , $x(t) = \cos\left(\omega_0 t + \frac{\pi}{3}\right)$	(3)
2	Find whether the signal is Energy or Power signal $x(t) = e^{-3t} u(t)$	(3)
3	State sampling theorem What is aliasing?	(3)
4	Discuss the relation between Fourier Transform and Laplace Transform	(3)
5	Write the properties of ROC of Z Transform	(3)
6	Explain the condition for the existence of DTFT	(3)
7	What is zero padding? Why is it used?	(3)
8	List out the properties of DFT	(3)
9	Explain the differences and similarities between DIT and DIF algorithms	(3)
10	Compute 4-point DFT of a sequence $x(n) = \{0,1,2,3\}$ using DIT algorithm	(3)

PART B
Answer any one full question from each module, each carries 14 marks.

Module I

11 a) Determine whether the system represented by the $y(t) = at^2 x(t) + btx(t-4)$ (10)

is

      i)   Static or Dynamic

      ii)   Linear or non-Linear

      iii)   Causal or non-causal

      iv)   Time-invariant or time variant

    b) Examine whether the signal, $x(t) = \sin(10t+1) - 2\cos(5t-2)$ is periodic or   (4)
not? If periodic determine the fundamental period,

OR

12 a) Sketch $x(t) = 3r(t-1) + r(-t+2)$ (8)

    b) Determine whether the given system is linear or not   (6)

$$\frac{dy(t)}{dt} + ty(t) = x^2(t)$$

Module II

13 a) Find the Fourier Transform of the signal x1(t) shown in Figure 1 using convolution property and time shift property of Fourier Transform (8)

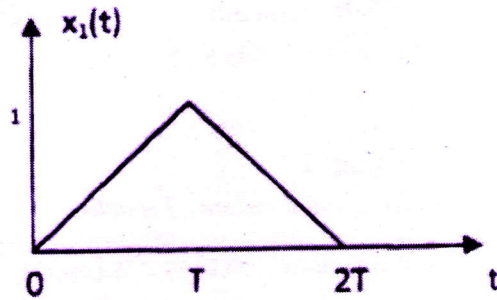
Figure 1

b) Find the Laplace Transform and ROC of the signal (6)

$$x(t) = e^{-2t} + 3e^{-3t} u(t)$$

OR

14 a) If $x(t)$ has a Fourier Transform $X(\omega)$, find the Fourier Transform of (8)

    i) $x_1(t) = x(3t - 4)$

    ii) $x_2(t) = \frac{d}{dt}x(t - 2)$

b) Explain sampling theorem. How can we avoid aliasing? (6)

Module III

15 a) Find the Z-transform and ROC of X(z) for $x(n) = 3\left(\frac{5}{7}\right)^n u(n) + 2\left(-\frac{1}{3}\right)^n u(n)$, (10)

Also find the Pole-Zero location

b) Distinguish between one-sided and two-sided Z-transforms. What are their applications? (4)

OR

16 a) Find the Z-transform of $y(n) = x(n - 1)u(n)$ (8)

b) Discuss the relation between discrete time Fourier transform and Z-transform (6)

Module IV

17 a) Determine the 8-point DFT of the sequence $x(n) =$ (10)

$\{1,1,1,1,1,1,0,0\}$

b) List any four properties of DFT (4)

OR

18 a) Find IDFT of the sequence $X(k) = \{5, 0, 1 - j, 0, 1, 0, 1 + j, 0\}$ (10)

    b) Distinguish between the overlap save and overlap add methods (4)

Module V

19 a) Given $x(n) = 2^n$ and N=8, find X(k) using DIT-FFT algorithm (10)

    b) Differentiate between DIT-FFT and DIF-FFT algorithms (4)

OR

20 a) Obtain the direct form II realization for the system described by the difference (7)
       equation $y(n) = -0.1y(n-1) + 0.72y(n-2) + 0.7x(n) - 0.252x(n-2)$

    b) Realize the system with difference equation $y(n) = \frac{3}{4} y(n-1) - \frac{1}{8} y(n-2) +$ (7)
       $x(n) + \frac{1}{3} x(n-1)$ in cascade form

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