



Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S6 (S, FE) Examination December 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 | Differentiate between even and odd signals. | (3) |
| 2 | Determine whether the signal given is periodic or not. If periodic, determine fundamental period. Given $x(n) = \cos(3\pi n)$ | (3) |
| 3 | State the Dirichlet's conditions for the convergence of Fourier series. | (3) |
| 4 | Determine the Fourier transform of the signal $x(t) = \delta(t)$. | (3) |
| 5 | State any 3 properties of z-transform | (3) |
| 6 | Give the relation between DTFT and z-transform of a discrete time signal. | (3) |
| 7 | Explain convolution property of DFT | (3) |
| 8 | Explain the concept of zero padding. | (3) |
| 9 | What is twiddle factor | (3) |
| 10 | How many complex multiplications and additions are needed to compute N point DFT. | (3) |

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

- 11 a) Check whether the signals given are periodic or not. If periodic, Find the fundamental periods. (6)
- a. $x(t) = \sin 2t + \cos 3\pi t$
- b. $\sin 2\pi t + \cos \sqrt{2}\pi t$
- b) Determine whether the following system is static, time invariant, linear and causal. (8)
- (x and y denote input and output respectively). Give explanation for each.
- $y(t) = t^2 x(t) + x(t - 2)$

OR

- 12 a) Given $x(t) = u(t+1) + u(t-1) - u(t-2) - u(t-4)$. (8)
- Plot (i) $x(t)$ (ii) $x(t-3)$ (iii) $x(2t)$ (iv) $x(2t-3)$

b) Check whether the following signals are energy or power signals. (6)

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

ii) $x(t) = tu(t)$

Module II

13 a) Determine the Fourier transform of the following signals (10)

1) $x(t) = \sin(\Omega_0 t)$

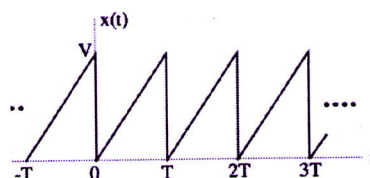
2) $x(t) = \text{sgn}(t)$

b) Explain the relationship between the Fourier transform & Laplace transform. (4)

OR

14 a) State the sampling theorem for a low pass signal. What is aliasing? (6)

b) (8)



Find the complex exponential Fourier series of the periodic signal shown in Figure

Module III

15 a) Find the DTFT of the discrete time signal $x(n) = a^{|n|}$, $-1 < a < 1$ (7)

b) A discrete time signal is expressed as $x(n) = \delta(n+1) + 2\delta(n) + 5\delta(n-3) - 2\delta(n-4)$. (7)

Find its z- transform.

OR

16 a) State the properties of the Region of Convergence (ROC) of z-transform. (4)

b) Compute the z-transform and ROC of the following sequences. (10)

i) $x(n) = a^n u(n)$

ii) $x(n) = -b^n u(-n - 1)$

Module IV

17 a) Find the convolution of $x(n) = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$ and $h(n) = \{2, 4, 6\}$ using overlap add method and overlap add method. (14)

OR

18 a) Find the number of complex multiplications and additions involved in the calculation of 1024 DFT using direct computation and radix2 FFT algorithm? (4)

- b) The first eight points of the 14-point DFT of a real valued sequence are [12, - (6)
 $1+3j, 3+j4, 1-j5, -2+j2, 6+j3, -2-j3, 10]$

Determine the remaining points.

- c) State any 4 properties of DFT (4)

Module V

- 19 a) Find the 8 point DFT of the sequence $x(n) = \{1, 2, 3, 4, 4, 3, 2, 1\}$ using DITFFT (10)
 radix2 algorithm.

- b) Compare DIT and DIF algorithms. (4)

OR

- 20 a) Draw the direct form 1 and direct form 2 structures for the difference equation (10)
 $y(n) = x(n) + 0.5x(n-1) + 3y(n-1) - 2y(n-2).$

- b) Draw the basic butterfly for DIT and DIF algorithms (4)
