Reg No.:_____ Name:_____

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

Sixth Semester B.Tech Degree (R,S) Examination May 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 | Check whether the signal,$x(t) = 2\cos(5t+1) - sin4t$ is periodic or not. If periodic, determine the fundamental period | (3) |
| 2 | State the difference between causal and non-causal system. | (3) |
| 3 | Write the expression for the trigonometric Fourier series coefficient | (3) |
| 4 | Find the Laplace transform of $x(t) = [1 + sin2t\cos 2t]\,u(t)$ | (3) |
| 5 | State the convolution property of Z-Transform | (3) |
| 6 | Prove that $u(n) \overset{ZT}{\leftrightarrow} \frac{z}{z-1} = \frac{1}{1-z^{-1}}; ROC; \lvert z\rvert > 1$ | (3) |
| 7 | List any three properties of DFT | (3) |
| 8 | Obtain the circular convolution of the following sequence $x(n) = \{1,2,1\}$; $h(n) = \{1,-2,2\}$ | (3) |
| 9 | Draw the basic butterfly diagram for DIT algorithm | (3) |
| 10 | What are the different types of structures for realization of IIR systems? | (3) |

## PART B

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

### Module I

11 a) 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.

$$y(t) = t^2x(t) + x(t-2)$$

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

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

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

**OR**

12 a) Find the output of an LTI system with impulse response h(t) to the input x(t). (8)

Given $x(t) = u(t) - u(t-2)$ and $h(t)$ is shown in Figure 1

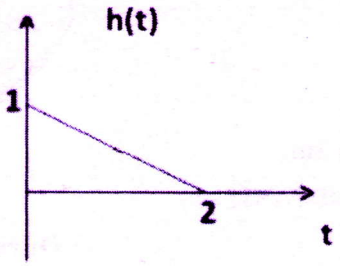


Figure 1

b) Sketch the signals (6)

(i) $y(t) = u(0.5t + 2)$

(ii) $y(n) = u(n+4) - u(n-2)$

**Module II**

13 a) Sketch and find the magnitude and phase spectra of the following signals (7)

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

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

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

Using Fourier Transform

b) Find the Laplace transform and ROC of the two-sided signal (7)

$$x(t) = 3e^{-2t}u(t) + 4e^{3t}u(-t)$$

**OR**

14 a) State and derive the sampling theorem for low pass signal with the conditions for regular intervals of sampling frequency , $\omega_s > 2\omega_n, \omega_s = 2\omega_n, \omega_s < 2\omega_n$ over the frequency spectrum. (14)

**Module III**

15 a) Find the Z-transform of (10)

(i) $y(n) = x(n-1)u(n)$

(ii) $y(n) = x(n+1)u(n)$

b) Prove that, for causal sequence , the ROC is the exterior of a circle of radius r. (4)

**OR**

16 a) Prove that the sequences (10)

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

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

Have the same $X(z)$ and differ only in ROC . Also plot their ROCs

b) List any four properties of Z-transform (4)

**Module IV**

17 a) Determine the output response $y(n)$ if $h(n) = \{1,1,1,\}$; $x(n) = \{1,2,3,1\}$ by using linear convolution method (10)

b) Discuss the relationship between DFT and z-transform. (4)

**OR**

18 Find the output $y(n)$ of a filter whose impulse response is $h(n) = \{1,1,1\}$ and input signal $x(n) = \{3,-1,0,1,3,2,0,1,2,1\}$ using (i)overlap-save method (ii)overlap-add method (14)

**Module V**

19 Compute the 8-point DFT of the sequence (14)

$$x(n) = \begin{cases} 1, & 0 \le n \le 7 \\ 0, & otherwise \end{cases}$$

Using DIT and DIF Radix-2 FFT algorithm

**OR**

20 Obtain the direct form I, direct form II, cascade and parallel form realisation for the system (14)

$$y(n) = -0.1y(n-1) + 0.2y(n-2) + 3x(n) + 3.6x(n-1) + 0.6x(n-2)$$

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