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Reg No.:_____ Name:_____

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

Sixth Semester B.Tech Degree Regular and Supplementary Examination June 2023 (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 | Sketch the signal u(t+4) u(-t+4). | (3) |
| 2 | Find the fundamental period of the signal x(t)=Sin10πt +Cos20πt. | (3) |
| 3 | State the sampling theorem for low pass signals. | (3) |
| 4 | State and prove Parseval's relation for CTFT. | (3) |
| 5 | List out 3 properties of ROC. | (3) |
| 6 | Find the DTFT of δ[n+3]- δ[n-3] | (3) |
| 7 | What is zero padding ? Why is it used? | (3) |
| 8 | Determine the IDFT of X(k)={1,0,1,0}. | (3) |
| 9 | Compare radix2 DIF and DIT algorithm. | (3) |
| 10 | Draw the basic butterfly diagram for DIT algorithm | (3) |

## PART B

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

### Module I

11 a) Test the periodicity of the given signals, if periodic find the fundamental period (6)

i) u(t).Cos2t

ii) $\text{Cos}\left(\frac{7}{2}t\right)+\text{Sin2t}+3\text{Cos}\left(\frac{7}{6}t\right)$.

b) Check whether the following signals are energy signals, power signals, neither energy nor power signals. (8)

i) $x(t)= e^{-10t}u(t)$

ii) $x[n]=\left(\frac{1}{2}\right)^{n} u[n]$

**OR**

12 a) Determine whether the given systems are static or dynamic, causal or non causal, time invariant or time variant, linear or non linear. (10)

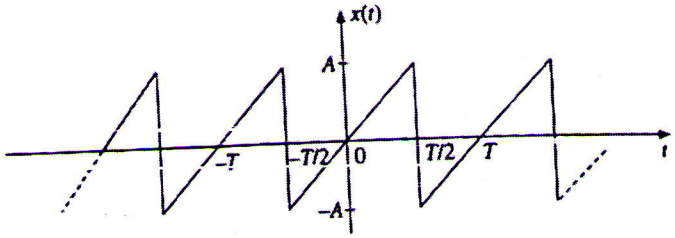
i) $y[n]=\text{Cos } x[n]$

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

b) Find the even and odd component of the signal $x(t)=(1+t^2+t^3)\text{Cos}^2 10t$. (4)

**Module II**

13 a) Determine the Fourier series expansion of the signal shown in figure. (8)




b) Find the Fourier transform of $e^{-a|t|}$. (6)

**OR**

14 a) Determine the Fourier series coefficient of $3\text{Sin}4\omega_0 t$ (5)

b) Determine the transfer function and impulse response of the system described by the differential equation. (9)

$$\frac{d^2y(t)}{dt} + 11\frac{dy(t)}{dt} + 24y(t) = 5\frac{dx(t)}{dt} + 3x(t)$$

**Module III**

15 a) Determine the Z Transform and ROC of the signal $2^n u[n]-3^n u[-n-1]$. (6)

b) Find the Inverse Z Transform of $\frac{3z^{-1}}{(1-z^{-1})(1-2z^{-1})}$ (8)

if i)ROC $|z|>2$ ii) ROC $|z|<1$ iii)ROC $1<|z|<2$

**OR**

16 a) Find the DTFS representation for (7)

$$x[n] = 5 + \sin\left(\frac{n\pi}{2}\right) + Cos\left(\frac{n\pi}{4}\right)$$

b) Find the DTFT of $\text{Sin}\left(\frac{n\pi}{2}\right)u(n)$ (7)

## Module IV

17 a) Find the 4 point DFT of the sequence $x[n]=Sin\left(\frac{n\pi}{2}\right)$ (8)

b) Find the circular convolution of the following sequence. (6)

x[n]={1,-1,2,3} and h[n]={0,1,2,3}

**OR**

18 Perform the linear convolution of the following sequence using overlap add method and overlap save method (14)

x[n]={1,2,3,4,5,6} and h[n]={2,1,-1}

## Module V

19 a) Compute the 8 point DFT of x(n) by radix-2 DIT FFT algorithm. (10)

x[n]={2,1,2,1,1,2,1,2}

b) Find the number of complex multiplications and additions involved in calculation of a 512 point DFT, using direct DFT and radix 2 FFT (4)

**OR**

20 a) Obtain the cascade and parallel form realizations of the system described by the equation (10)

$$y[n]-\frac{1}{4}y(n-1)+\frac{-1}{8}y(n-2)=x(n)+3x(n-1)+2x(n-2)$$

b) Obtain the direct form 1 form realizations of the system described by the equation (4)

$$y[n]-\frac{5}{6}y(n-1)+\frac{1}{6}y(n-2)=x(n)+2x(n-1)$$

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