Register No.: .... Name: ....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FOURTH SEMESTERB.TECH DEGREE EXAMINATION (Regular), JULY 2022
ELECTRONICS AND COMMUNICATION ENGINEERING
(2020 SCHEME)

Course Code: **20ECT204**

Course Name: **Signals and Systems**

Max. Marks: **100** **Duration: 3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

1. Determine energy of the signal x(t) = e^{-2t} u(t)
2. Check if the signal below is periodic. If so, find the fundamental period.
   $$x[n] = \sin\left(\frac{2\pi n}{5}\right) + \cos\left(\frac{2\pi n}{3}\right).$$
3. Perform linear convolution of signals x_1[n] = [2, 2, 2, 2] and x_2[n] = [1, 1, 1, 1]
4. Check the causality and stability of the LTI system with impulse response
   $$h(t) = e^{-2t}u(t+2).$$
5. State the conditions for convergence of Fourier series.
6. Evaluate the Fourier transform of x(t)=sgn(t). Plot magnitude and phase response.
7. Find Laplace transform of
   $$x(t) = e^{-2t}u(t) + e^{-3t}u(t)$$
8. What is aliasing? When does aliasing occur?
9. Find Z transform of
   $$x[n] = n\, a^{n-1}u[n]$$
10. State Parseval's theorem for DTFT.

PART B

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

MODULE I

11. a) Check whether the system, y(t) = $x^2(2t)$ is (i) Linear (ii) Time-Invariant (iii) Causal (iv) Stable. (7)

    b) State superposition principle for linearity of system. Determine whether the following system is linear. (7)
    $$\frac{d^2}{dt^2}y(t) + 3ty(t) = \frac{t^2}{2}x(t)$$

OR

12. a) Determine if the following signals are energy signals, power signals or neither. Calculate the total energy and total average power for all signals. (7)

(i) $x(t) = (-0.5)^t\ u(t)$

(ii) $x(t) = A\sin(\omega_0 t + \theta)$

(iii) $x[n] = u[n]$

b) Given x(t) = u(t+1) + u(t-1) -u(t-2)-u(t-4).Plot (7)

(i) x(t)

(ii) x(t-3)

(iii) x(2t)

(iv) x(2t-3)

MODULE II

13. a) Compute and plot the autocorrelation of the signal $x(t) = A\cos(\omega_0 t + \theta)$, where θ is a constant between 0 and 2π. (6)

b) Evaluate the continuous time convolution integral for the following with proper plots. (8)

$$y(t) = \{u(t) - u(t - 2)\} * u(t).$$

OR

14. a) Find the output of a discrete LTI system described by the impulse response (7)

$$h[n] = [2\ \underset{\uparrow}{-4}\ 2], \text{to the input } x[n] = [1\ 2\ \underset{\uparrow}{3}\ 2\ 1]$$

b) Find whether the following systems with impulse responses h(t) are stable or not. (7)

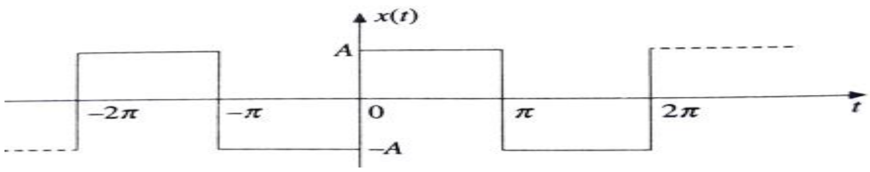
(i) $e^{-3t}u(t-1)$

(ii) $te^{-t}u(t)$

(iii) $e^{-t}\cos 2t\ u(t)$.

MODULE III

15. a) Find the trigonometric Fourier Series of the given continuous time square wave x(t). Plot the magnitude and phase spectra. (9)



b) Find the inverse Fourier transform of the following signals. (5)

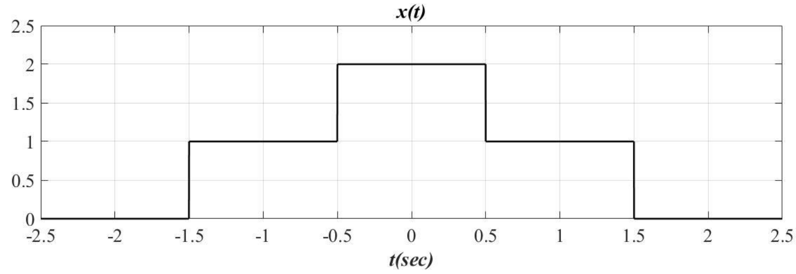
(i) $1/j\omega(j\omega+1) + 2\pi\delta(\omega)$

(ii) $2\pi\delta(\omega) + \pi\delta(\omega - 4\pi) + \pi\delta(\omega + 4\pi)$

OR

16\. (7)

a) Find the Fourier Transform of the following signal *x(t)*.



b) Find the CTFT of the given signal x(t) using an appropriate property. State and prove the property used. (7)

$$x(t) = te^{-at}u(t)$$

MODULE IV

17\.

a) State and prove the sampling theorem for low pass signals. (8)

b) Find the Nyquist rate and Nyquist interval for the signals (a) sinc (100πt) and b) sinc (100πt) + sinc(50πt). (6)

OR

18\. a) Write the equation for Laplace transform. What is ROC of Laplace transform? State any 5 properties of ROC. (8)

b) Explain the relationship between the Fourier transform & Laplace transform. (6)

MODULE V

19\. a) Evaluate the inverse Z-Transform by partial fraction method for the given X(z). (7)

$$X(z) = \frac{3 - \frac{5}{6}z^{-1}}{\left(1 - \frac{1}{4}z^{-1}\right)\left(1 - \frac{1}{3}z^{-1}\right)}, \quad |z| > \frac{1}{3}$$

b) Find the DTFT of $x[n]=u[n]-u[n-N]$. (7)

OR

20\. a) A causal discrete-time LTI system is described by (10)

y[n]-0.75y[n-1]+0.125y[n-2]=x[n].

where x[n] and y[n] are the input and output of the system respectively.

(a) Determine the system function H(z).
(b) Find the impulse response h[n] of the system.
(c) Find the step response s[n] of the system.

b) State any four properties of Z transform. (4)

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