C **750A3** Total Pages: **3**

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SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FOURTH SEMESTER B.TECH DEGREE EXAMINATION (S), AUGUST 2023
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. Differentiate between energy and power signals with examples for each.
2. Sketch the signal: $x(t) = -u(t+3) + 2u(t+1) - 2u(t-1) + u(t-3)$.
3. Find the expression for $y(t) = \delta(t - T_1) * \delta(t - T_2)$.
4. What is meant by correlation between two signals. How it is related to convolution?
5. For the signal, $x(t) = 2 + cos2t + sin4t$, determine the fundamental frequency and Fourier series coefficients C_0 and C_1.
6. Compare Fourier series and Fourier transform. Find the Fourier transform of $e^{3t}u(t)$.
7. State sampling theorem. Comment on the effects of selection of sampling rate.
8. State initial and final value theorems. Determine the initial value for $X(s) = \frac{s+4}{s^2+3s+5}$.
9. Find the ROC of $x(n) = \left(\frac{1}{2}\right)^n u(n-2)$.
10. What is DTFT? How is it related to Z transform?

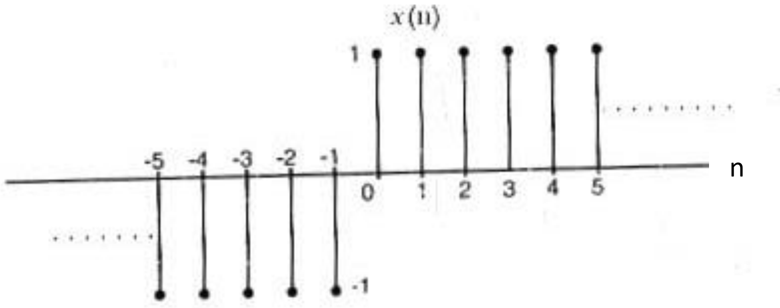
PART B

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

MODULE I

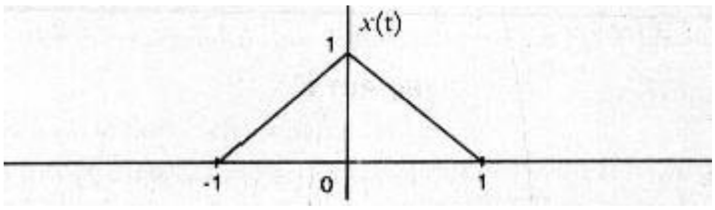
11. a) Determine whether the following signal is periodic or not. If periodic, determine the fundamental period. (6)
$x(n) = 1 + e^{j2\pi n/3} - e^{j4\pi n/7}$.

b) Sketch the even and odd components of the signal given in figure. (8)



OR

12. a) For the signal shown in Fig., Sketch the following (6)



a) $y(t) = x(2t+3)$
b) $y(t) = x(2t) + x(4t+3)$
c) $y(t) = x\{2(t-2)\}$.

b) Check whether the system is static, linear, causal and time-invariant $y(t) = at^2x(t) + btx(t-4)$. (8)

MODULE II

13. Find the convolution of the following signals. Verify your answer graphically also (14)

$$x_1(t) = e^{-2t}u(t);\ x_2(t) = e^{-4t}[u(t) - u(t-2)].$$

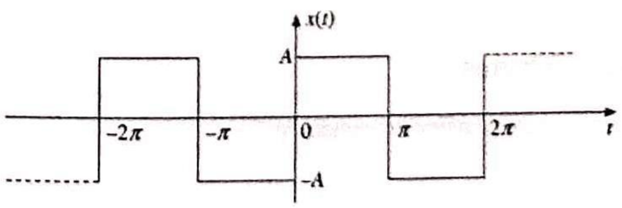
OR

14. a) Find the cross correlation between a triangular function and a gate function both having unit amplitude and extend from -1 to +1 in time axis using graphical method. (8)

b) Find the convolution of the signals $x_1(t) = te^{-t}u(t)$; $x_2(t) = te^{-2t}u(t)$ using Fourier transform. (6)

MODULE III

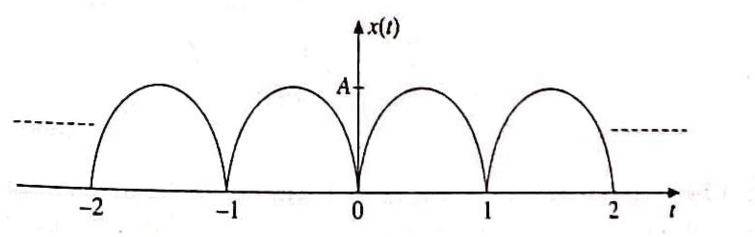
15. a) When applying the symmetry property, some of the Fourier series coefficients become zero. Justify this statement by obtaining the trigonometric Fourier series for the waveform given below. (8)



b) Find the Fourier transform of $x(t) = f(t-2) + f(t+2)$ by applying the properties. State the properties applied. (6)

OR

16. a) Find the exponential Fourier series for the waveform. (8)



b) Find Fourier transform, using its properties: $x(t) = e^{-3t}u(t-2)$. State the properties used. (6)

MODULE IV

17. a) Determine the Nyquist rate and Nyquist interval for the signal: (6)

$$x(t) = \frac{sin100\pi t}{100\pi t} + 3\left(\frac{sin60\pi t}{60\pi t}\right)^2$$

b) Find the inverse Laplace transform of $X(s) = \frac{5s+13}{s(s^2+4s+13)}; Re(s) > 0.$ (8)

OR

18. a) The output y(t) of a continuous time system is $2e^{-3t}u(t)$ when the input x(t) is u(t). Find (a) the impulse response h(t) of the system (b) the output y(t) when input x(t) is $e^{-t}u(t)$. (8)

b) Verify the initial and final value theorems of the signal with Laplace transform $X(s) = \frac{s}{(s+1)(s+2)}$. (6)

MODULE V

19. a) Find the Z transform of the sequence and sketch the ROC: $x(n) = \left(\frac{1}{3}\right)^n \sin\left(\frac{\pi}{4}n\right)u(n)$. (8)

b) A system has impulse response $h(n) = \left(\frac{1}{2}\right)^n u(n)$. Determine the input of the system if the output is given by $y(n) = \frac{1}{3}u(n) + \frac{2}{3}\left(\frac{-1}{2}\right)^n u(n)$. (6)

OR

20. a) Find the time domain signal corresponding to $X(z) = \frac{1+2z^{-1}+z^{-2}}{1-\frac{3}{2}z^{-1}+\frac{1}{2}z^{-2}}$. (6)

b) Using the power series method, find the inverse transform of $X(z) = \frac{1}{1-az^{-1}}$ $with\ (a)\ |z| > |a| (b)\ |z| < |a|$. (8)

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