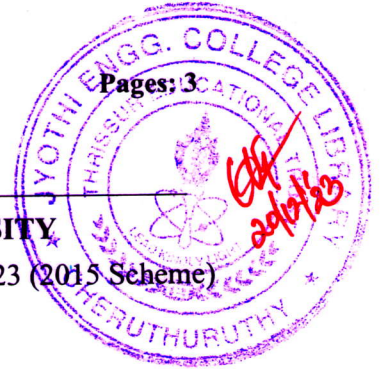Reg No.:_____   Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
B.Tech Degree S5 (S, FE) / S5 (PT) (S, FE) Examination December 2023 (2015 Scheme)

Course Code: EE307

Course Name: SIGNAL AND SYSTEMS

Max. Marks: 100   Duration: 3 Hours

PART A
Answer all questions, each carries 5 marks.   Marks

1   Represent the signals graphically. a) $x(t) = 5u(4 - t)$ (5)

     b) $x(t) = sgn(t)\delta(t + \frac{1}{2})$

2   Determine the step response of the system whose impulse response is given   (5)
     by $h(t) = u(t + 3) + u(t - 3)$.

3   Explain Dirichlet's conditions for existence of Fourier transform. Define   (5)
     trigonometric form of Fourier series

4   State Nyquist criterion for sampling. Determine the minimum sampling   (5)
     frequency and sampled version of analog signal. The analog signal is given by
     $x_a(t) = 5cos50\pi t + 2sin200\pi t$

5   List the properties of region of convergence of Z transform.   (5)

6   Prove that Z transform does not exists for $x(n) = \frac{1}{4}^n u(n) + \frac{1}{5}^n u(-n - 1)$ (5)

7   Write short notes on random signals and random process.   (5)

8   Write the Fourier series representation of a discrete time signal with periodicity   (5)
     N and differentiate between continuous time and discrete time Fourier series.

PART B
Answer any two full questions, each carries 10 marks.

9   a)   Determine the odd and even components of the given signals   (6)

          i) $x(t) = 10sin (5\pi t + \frac{\pi}{4})$

          ii) $x(t) = 2u(t)$

          iii) $x(t) = \{1, 2, 3, 4, 5\}$

     b)   Check whether the signals are periodic and find the fundamental period.   (4)

          i) $x(n) = tan(7\pi n + 4)$

ii) $x(t) = \cos\left(\frac{4\pi}{9}n\right) + 3e^{j\frac{3\pi}{4}n}$

10 a) Find inverse Laplace transform $of\ X(s) = \frac{4}{(s+2)(s+4)}$ when ROC is given by (6)

    i) $ROC = -2 > Re\{s\} > -4$

    ii) $ROC = \ \ Re\{s\} < -4$

    iii) $ROC = \ \ Re\{s\} > -2$

b) State and prove differentiation property of Laplace Transform (4)

11 a) Check whether the system given by $y(n) = nx^2(n)$ is causal, memoryless, linear, time variant and stable. (5)

b) State the condition for causality and stability of a system depending on the position of poles and ROC of Laplace transform. (5)

PART C
Answer any two full questions, each carries 10 marks.

12 a) Determine the trigonometric Fourier series of half wave rectified sine wave output. (10)
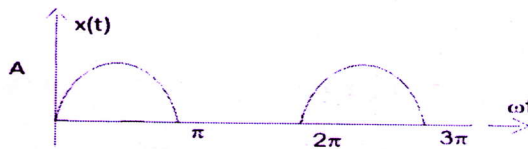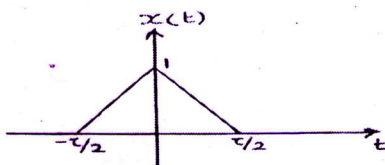

13 a) Find the forced response of the system given by $y(n) + y(n-1) - 2y(n-2) = x(n-1) + 2x(n-2)$ when excited by the input $x(n) = \delta(n)$ (10)

14 a) Find the response of the system using linear convolution. (5)

$$x(n) = \delta(n+1) + \delta(n) + \delta(n-1)$$
$$h(n) = 2\delta(n+1) + \delta(n) + 2\delta(n-1)$$

b) Find the Fourier transform of the given signal using differentiation property of Fourier Transform (5)

PART D

Answer any two full questions, each carries 10 marks.

15 a) Find impulse response of the system described by the difference equation using Z   (7)
        Transform. $y(n) - 3y(n-1) - 4y(n-2) = x(n) + 2x(n-1)$

    b) Find the inverse Z transform of $X(z) = \log(1 + az^{-1}), ROC\ |z| > |a|$ (3)

16 a) Describe the properties of non linear systems.   (5)

    b) Determine the stability and causality of the system $H(z) = \frac{1}{1-0.25z^{-1}} + \frac{1}{1-2z^{-1}}$ (5)
        ROC :$0.25 < |z| < 2$

17 a) State and prove four properties of discrete time Fourier series.   (10)

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