**University of Engineering & Management, Kolkata**

**Term - I Examination, August - September, 2021**

**Programme Name: B.Tech in Computer Science** **Semester: 5th**

**Course Name: Signals & Systems**

**Course Code: ESC501**

**Full Marks: 100** **Time: 3 hours**

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## GROUP A (20 Marks)

**Answer the following questions. Each question is of 2 marks.**

**1.**

**i.** Define signal.

**ii.** Draw the impulse function and impulse train function.
Represent the finite duration sequence in graphical representation
x(n) = {1,2,2,0,5,1,5}

**iii.** Find the following summation:

$$\sum_{n=-\infty}^{\infty} n^2 \delta(n+2)$$

**iv.** Sketch the following signal
x(n)=u(n-1)-u(n-4)
where, u(n) is the discrete step signal.

**v.** Define static and dynamic systems.

**vi.** Check whether the following system is time variant or not with proper justification.
dy/dx (t) + 2ty(t) = x(t)

**vii.** Check whether the following system is time variant or not with proper justification. dy/dx (t) + 2ty(t) = x(t)

**viii.** State the convergence condition on Fourier series.

**ix.** Define Fourier Transform.

**x.** Explain periodic functions with examples.

## GROUP B (30 Marks)

**Answer the following questions. Each question is of 5 marks.**

**2.** Consider the signal x(t)=[cos t + sin t + cos t sin t]. Find the even and odd component of the signal x(t).

**3.** State the conditions for a function f(t) to be Laplace Transformable.

4. Represent the sequence x(n) in sum of shifted impulse response. X(n)={-2 1 -2 1 3}

5. **A.** Evaluate the period of the signal x(t) = 5 sin (10 πt) - 2 cos (20 πt)

**OR**

**B.** Find whether the system is time variant or not.
y(n)=x(n+2)

6. **A.** Explain Dirichelet's conditions for a function to be expanded as a Fourier Series.

**OR**

**B.** State and prove the time shifting property of Discrete-time Fourier Transform.

7. **A.** Write the complex form of a Fourier Series f(x) defined in the interval (c, c+2l)

**OR**

**B.** Find the Fourier Series of

$$f(x) = x + x^2 \ in \ (-\pi, \pi)$$

## GROUP C (50 Marks)

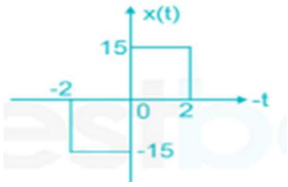
**Answer the following questions. Each question is of 10 marks.**

8. i) x(n) = {-2, 1, 2, -1, 3}
n = -2, -1, 0, 1, 2
Find the even and odd component of the discrete signal.

ii) State the properties of impulse signals.

9. i) Whether the signal is energy or power signal
x(t) = t.u(t), in the continuous time domain.

ii) Find the signal is even or odd with proper explanation




10. **A.** i) Define convolution with suitable examples.
ii) Evaluate the Laplace Transform of the following

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

**OR**

**B**. i) State the properties of the LTI system.

ii) Find the Laplace transform of the signal

$$x(t) = e^{-5t}[u(t) - u(t-5)]$$

**11. A**. i) Write the formula for Fourier constants for f (x) in the interval (−□, □).

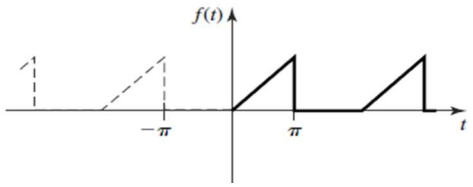
ii) Find the constant $a_0$ of the Fourier series for function

$$f(x) = x \text{ in } 0 \le x \le 2\pi .$$

**OR**

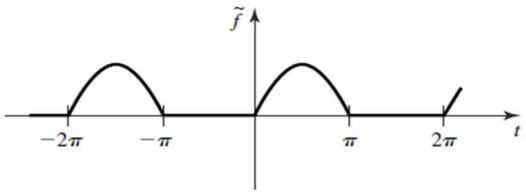
**B**. Find the Fourier series expansion for the periodic function f (t) if in one period

$$f(t) = \begin{cases} 0, & -\pi < t < 0 \\ t, & 0 < t < \pi \end{cases}$$




**12.** A. i) Find the Fourier series for the periodic extension of

$$f(t) = \begin{cases} \sin t, & 0 \le t \le \pi \\ 0, & \pi \le t \le 2\pi \end{cases}$$




ii)Write the proof of properties of Fourier Transform Linearity.

OR

B. i) Explain the **Duality** property of Fourier Transform.

ii) Find the Fourier transform of

$e^{at}$u(-t) for a>0

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