



Department of Electronics & Communication  
**NATIONAL INSTITUTE OF TECHNOLOGY SRINAGAR**  
**MAJOR EXAMINATION**

Course: Signals & Systems  
Semester: 3rd  
Date: 27/11/18

Time: 3 hrs  
Max. Marks: 60  
Code: ECE 303

Attempt any four questions

Q1. C303.1

(a) Find the even & odd components of the following signals:

i.  $x(t) = 1 + t + 3t^2 + 5t^3 + 9t^4$

ii.  $x(t) = 1 + t \cos t + t^2 \sin t + t^3 \sin t \cos t$

iii.  $x(t) = (1 + t^3) \cos^3(10t)$

[6]

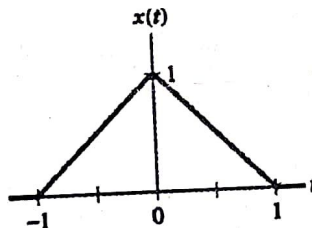
(b) For each of the following signals, determine whether it is periodic, and if it is, find the fundamental period:

i.  $x(t) = \sin^3(2t)$

ii.  $x(n) = \cos(2\pi n)$

[3]

(c) A triangular pulse  $x(t)$  is depicted in the figure below. Sketch each of the following signals derived from  $x(t)$ :



i.  $x(2(t-2))$

ii.  $x(-2t-1)$

iii.  $x(3t) + x(3t+2)$

[6]

Q2. C303.2, C303.3

(a) Explain the following properties of systems along with their mathematical proof:

i. Time Invariance

ii. Invertibility

[6]

(b) Describe the necessary and sufficient condition for the causality of an LTI system.

[3]

(c) Let the impulse response of an LTI system be given by:

$$h(t) = u(t-1) - u(t-4)$$

Find the output of the system in response to the input:

$$x(t) = u(t) + u(t-1) - 2u(t-2)$$

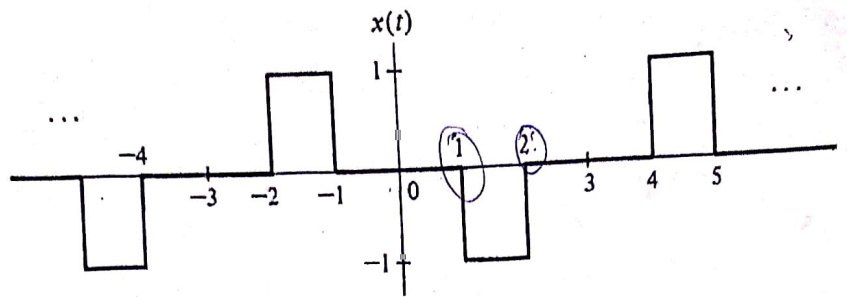
[6]

Q3. C303.4

(a) By evaluating the Fourier series analysis equation, determine the Fourier series for the

End of Paper

following signal:



[4]

(b) Explain the following properties of Fourier Transform:

- Duality & symmetry property
- Conjugate Functions

[6]

(c) Obtain the Fourier transform of following functions:

- $x(t) = \sin \omega_0 t$
- $x(t) = te^{-at}u(t)$

[5]

Q4. C303.5

(a) Determine the Laplace Transform & the associated ROC for the following functions:

- $x(t) = e^{-at}u(t) \quad a > 0$
- $x(t) = e^{-at}u(t) \quad a < 0$
- $x(t) = -e^{-at}u(-t) \quad a < 0$

[6]

(b) Explain the Initial and Final Value Theorem along with the mathematical proof.

[4]

(c) Obtain the Inverse Laplace Transform of following function using Convolution Integral:

[5]

$$F(s) = \frac{1}{s^2(s^2 - a^2)}$$

Q5. C303.6

(a) Solve the differential equation using Laplace Transform method:

$$\ddot{y} + 9\dot{y} + 20y = x(t)$$

[7.5]

$$\text{Given: } y(0) = 1, \dot{y} = -2, x(t) = 2u(t)$$

(b) Given PDF:  $12x^3 - 21x^2 + 10x$   $0 \leq x \leq 1$

Find:

- $P(x \leq 1/2)$
- $P(x > 1/2)$
- Find k, where  $P(x \leq k) = 1/2$

[2.5, 2.5, 2.5]