Code No: 133BQ **R16**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year I Semester Examinations, September/October - 2023
SIGNALS AND STOCHASTIC PROCESS
(Electronics and Communication Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART- A

(25 Marks)

1.a) Express signum function using unit step functions. [2]
b) Discuss the concept of orthogonality and explain the term complete set of orthogonal functions. [3]
c) Write notes on complex Fourier spectrum. [2]
d) Write properties of trigonometric Fourier series. [3]
e) Write any two properties of ROC of Laplace transform. [2]
f) Distinguish Laplace, Fourier and Z transforms. [3]
g) Write the conditions to be satisfied by a random process to be SSS. [2]
h) Write short notes on Poisson random process. [3]
i) Define the Auto correlation function. [2]
j) Write properties of cross power density spectrum. [3]

PART-B

(50 Marks)

2.a) State and prove convolution property of Fourier transforms.
b) Derive the relationship between rise time and bandwidth. [5+5]

OR

3.a) Discuss Paley – Wiener criterion for physical realizability of filter.
b) Present the analogy between vectors and signals. [5+5]

4.a) Obtain the complex exponential Fourier series for the wave form shown below figure 1 and also plot its magnitude spectrum.

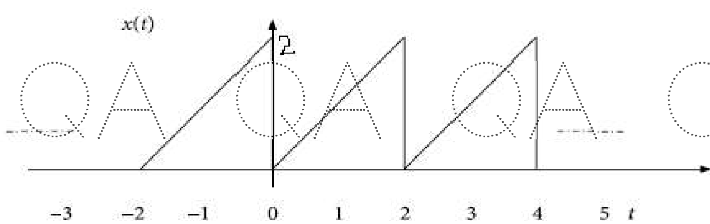

Figure 1

b) Find the Fourier transform of signum function. [5+5]

OR

5.a) Compute the Fourier transform of the signal shown below figure 2.

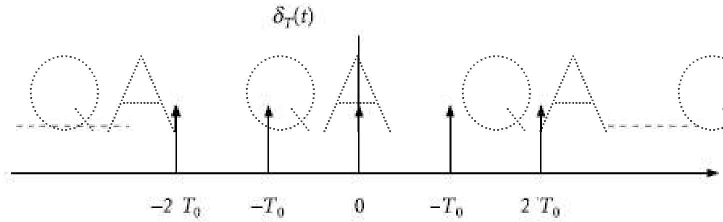

Figure 2

b) Discuss the effects of under sampling. [5+5]

6.a) Find the Laplace transform and ROC of x(t) = cos(2t) u(t-2)

b) Explain the constraints on ROC for various classes of signals in Z-transform. [5+5]

OR

7.a) Find the laplace transform of $x(t) = -t^2 e^{-at} u(t)$ and it's ROC.

b) Using time shifting property find the Z transform of $x[n] = (2/3)^n u[n-1]$. [5+5]

8.a) Classify random processes and explain.

b) Define auto-correlation function of a random process. Write properties of ACF and prove any two of them. [5+5]

OR

9.a) A random process X(t) = Acos(ωt+θ), where θ is a uniformly distributed random variable in (0, 2π). Check whether it is WSS or not?

b) An LTI system with impulse response h(t) has auto-correlation functions of its input and output represented by $R_{YY}(\tau)$, $R_{XX}(\tau)$ respectively.

Prove that $R_{YY}(\tau) = R_{XX}(\tau) * h(-\tau) * h(\tau)$. [5+5]

10. Derive the expression for power density spectrum of a random process. [10]

OR

11. Derive the relationship between autocorrelation function and power density spectrum of a random process. [10]

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