

R16

Code No: 133BQ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**B.Tech II Year I Semester Examinations, May/June - 2019****SIGNALS AND STOCHASTIC PROCESS****(Common to ECE, ETM)****Time: 3 Hours****Max. Marks: 75****Note:** This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit.

Each question carries 10 marks and may have a, b, c as sub questions.

PART- A**(25 Marks)**

- 1.a) Give the condition for the physical reliability of a system. [2]
- b) What are the properties of convolution? [3]
- c) State any two properties of Fourier series. [2]
- d) Find the Fourier transform of the signal $x(t) = 20 \text{ sinc}(20t)$. [3]
- e) Explain the concept of region of convergence for Laplace transforms. [2]
- f) Write the differentiation in time property of Laplace transform. [3]
- g) Define random process. [2]
- h) Give the relation between correlation and Convolution. [3]
- i) Verify that the cross spectral density of two uncorrelated stationary random processes is an impulse function. [2]
- j) Define cross –spectral density and its examples. [3]

PART-B**(50 Marks)**

2. Graphically convolve the signals

$$X_1(t) = \begin{cases} 1; & \text{for } -T \leq t \leq T \\ 0; & \text{elsewhere} \end{cases} \quad \text{and} \quad X_2(t) = \begin{cases} 1; & \text{for } -2T \leq t \leq 2T \\ 0; & \text{elsewhere} \end{cases} \quad [10]$$

OR

- 3.a) What is an LTI system? Explain the properties of it.
- b) Find whether $x(t) = A e^{-\alpha(t)} u(t)$, $\alpha > 0$ is an energy signal or not. [5+5]

- 4.a) Obtain the Fourier series coefficients for $x(t) = A \sin \omega_0 t$.
- b) What is the Significance of Hilbert Transform? Explain. [5+5]

OR

5. Define Fourier transform. Explain the properties of Fourier transform. [10]

- 6.a) Find the Laplace transform of $x(t) = -t^2 e^{-at} u(-t)$ and indicate its ROC.
- b) Find the inverse Laplace transform of $x(s) = 5(s+5)/s(s+3)(s+7)$; $\text{Re}(s) > -3$. [5+5]

OR

- 7.a) Find the inverse Z- transform of $X(z) = \frac{1+3z^{-1}}{1+3z^{-1}+2z^{-2}}$ for different possible ROCs.
- b) Give the relationship between z-transform and Laplace Transform. [7+3]

- 8.a) A Random Process $X(t) = A \cos(2\pi f_c t)$, where A is a Gaussian Random Variable with zero mean and unity variance, is applied to an ideal integrator, that integrates with respect to 't', over $(0, t)$. Check the output of integrator for stationarity.
- b) A random Process is defined as $X(t) = 3 \cos(2\pi t + Y)$, where Y is a random Variable with $p(Y=0) = p(Y=\pi) = 1/2$. Find the mean and Variance of the Random Variable $X(2)$. [5+5]

OR

- 9.a) State and prove properties of cross correlation function.
- b) If the PSD of $X(t)$ is $S_{xx}(\omega)$. Find the PSD of $dx(t)/dt$. [5+5]
- 10.a) Find and plot the Autocorrelation function of
(i) Wide band White noise (ii) Band Pass White noise.
- b) Derive the expression for the Cross Spectral Density of the input Process $X(t)$ and the output process $Y(t)$ of an LTI system in terms of its Transfer function. [5+5]

OR

11. The auto correlation function of a random process $X(t)$ is $R_{xx}(\tau) = 3 + 2 \exp(-4\tau^2)$
- a) Evaluate the power spectrum and average power of $X(t)$.
- b) Calculate the power in the frequency band $-1/\sqrt{2} < \omega < 1/\sqrt{2}$. [5+5]

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