

Code No: 133BQ

R16

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year I Semester Examinations, November/December - 2017

SIGNALS AND STOCHASTIC PROCESS

(Electronics and Communication Engineering)

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) Write about unit step function and unit impulse function. [2]
- b) Define signal bandwidth and system bandwidth. [3]
- c) Determine the complex exponential Fourier series representation for  $x(t) = \cos\left(2t + \frac{\pi}{4}\right)$ . [2]
- d) Find the Fourier transform of  $x(t) = e^{j\omega_0 t}$ . [3]
- e) Find the Laplace transform of  $x(t) = -e^{at} u(-t)$ . [2]
- f) Write the differences between the continuous-time signal  $e^{j\omega_0 t}$  and the discrete-time signal  $e^{j\omega_0 n}$ . [3]
- g) Explain about second order stationary process. [2]
- h) Explain about Cross- Covariance function. [3]
- i) Define Cross-Power Spectrum function. [2]
- j) Find auto correlation function for  $S_{XX}(\omega) = \frac{8}{(9+\omega^2)^2}$ . [3]

**PART-B**

(50 Marks)

- 2.a) Define orthogonal signal space and orthogonal vector space. Bring out clearly its applications in representing a signal and vector respectively.
- b) Explain how functions can be approximated using orthogonal functions. [5+5]

**OR**

- 3.a) Derive the relationship between rise time and bandwidth.
- b) State and Prove the Convolution property of Fourier transform. [5+5]
- 4.a) Expand following function  $f(t)$  by trigonometric Fourier series over the interval (0,1). In this interval  $f(t)$  is expressed as  $f(t) = At$
- b) State and prove multiplication property of continuous time Fourier series. [5+5]

**OR**

- 5.a) Find the Fourier transform of symmetrical gate pulse and sketch the spectrum.
- b) State and prove sampling theorem for band limited signals using analytical approach. [5+5]
- 6.a) State and prove the properties of ROC of Laplace transform.
- b) Find the inverse Laplace transform of  $X(s) = \frac{5s+13}{s(s^2+4s+13)}$ ,  $\text{Re}(s) > 0$ . [5+5]

**OR**

- 7.a) Find  $X(z)$  and sketch the zero-pole plot and the ROC for  $a < 1$  and  $a > 1$  for the signal  $x[n] = a^{|n|}$ .
- b) Determine the inverse Z transform of  $X(z) = \log\left(\frac{1}{1-az^{-1}}\right)$ ;  $\text{ROC } |z| > |a|$ . [5+5]

- 8.a) Explain briefly about Gaussian and Poisson Random Process.  
b) Show that the random process  $X(t) = A \cos(\omega_0 t + \theta)$  is wide-sense stationary if it is assumed that  $A$  and  $\omega_0$  are constants and  $\theta$  is a uniformly density random variable over the interval  $(0, 2\pi)$ . [5+5]

OR

- 9.a) Explain about Auto-correlation function with their properties.  
b) Show that mean square value of output response is independent of time  $t$ . [5+5]  
10. Explain about cross power spectrum density and its properties with proofs. [10]

OR

11. Derive the relationship between cross-power spectrum and cross correlation function. [10]

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