

Code No: 133BQ

R16

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year I Semester Examinations, April/May - 2018

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) What is meant by Total response? [2]
- b) Define Unit step function and Signum function. [3]
- c) State "time shift" property of Fourier transform. [2]
- d) Define aliasing effect? How can you overcome? [3]
- e) What is the time shifting property of Z transform? [2]
- f) Define inverse Laplace transform. State the linearity property for Laplace transforms. [3]
- g) Give an example of evolutionary random process. [2]
- h) List the properties of Cross correlation function. [3]
- i) Define wiener khinchine relations. [2]
- j) State any two properties of cross-power density spectrum. [3]

PART-B

(50 Marks)

2. Define the error function while approximating signals and hence derive the expression for condition for orthogonality between two waveforms $f_1(t)$ and $f_2(t)$. [10]
- OR
3. Obtain the impulse response of an LTI system defined by $dy(t)/dt + 2y(t) = x(t)$. Also obtain the response of this system when excited by $e^{-2t}u(t)$. [10]
4. State and prove sampling theorem for band limited signals. [10]
- OR
- 5.a) State and prove Differentiation and integration properties of Fourier Transform.
- b) Obtain the expressions to represent trigonometric Fourier coefficients in terms of exponential Fourier coefficients. [5+5]
6. Determine the inverse Laplace of the following functions.
a) $1/s(s+1)(s+3)$ b) $3s^2+8s+6 / (s+8)(s^2+6s+1)$. [5+5]

OR

- 7.a) Find the Inverse Z transform of

$$X(z) = \frac{z+2}{4z^2 - 2z + 3}; |z| < \sqrt{\frac{3}{4}}$$

- b) Find the Z transform of $x[n] = a^{n+1}u[n+1]$. [5+5]

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8.a) $X(t)$ is a random process with mean $=3$ and Autocorrelation function $R_{xx}(\tau) = 10[\exp(-0.3|\tau|) + 2]$. Find the second central Moment of the random variable $Y = X(3) - X(5)$.

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b) $X(t) = 2A \cos(\omega_c t + \theta)$ is a random Process, where ' θ ' is a uniform random variable, over $(0, 2\pi)$. Check the process for mean ergodicity. [5+5]

OR

9.a) A random process is defined as $X(t) = A \cos(\omega_0 t + \Theta)$, where Θ is a uniformly distributed random variable in the interval $(0, \pi/2)$. Check for its wide sense stationarity? A and ω_0 are constants.

b) Given the auto correlation function for a stationary ergodic process with no periodic components is $R_{xx}(\tau) = 25 + 4/(1 + 6\tau^2)$. Find mean and variance of process $X(t)$. [5+5]

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10.a) Compare and contrast Auto and cross correlations.

b) If $Y(t) = A \cos(\omega_0 t + \theta) + N(t)$, where ' θ ' is a uniform random variable over $(-\pi, \pi)$, and $N(t)$ is a band limited Gaussian white noise process with PSD $= K/2$. If ' θ ' and $N(t)$ are independent, find the PSD of $Y(t)$. [5+5]

OR

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11. Given $R_{xx}(\tau) = A e^{-\alpha|\tau|}$ and $h(t) = e^{-\beta t} u(t)$ where $u(t) = \begin{cases} 1; & t \geq 0 \\ 0; & \text{otherwise} \end{cases}$. Find the spectral density of the output $Y(t)$. [10]

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