Code No: R1621045 **R16** SET - 1

II B. Tech I Semester Model Question Paper Sept - 2017
RANDOM VARIABLES AND STOCHASTIC PROCESSES
(Electronics and Communications Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A [7 x 2 =14]

1. a) Define random variable and conditions to be satisfied by it.
   b) If K is a constant, then for a random variable X, prove that $Var(KX)=K^2 var(X)$.
   c) State central limit theorem.
   d) Write the properties of Cross correlation Function of Random Process
   e) Write the properties of cross power density spectrum
   f) Define noise figure.
   g) What is the physical significance of variance?

PART –B

2. a) Explain Gaussian random variable with neat sketches? (7M)
   b) Discuss the characteristics of Binomial, Rayleigh random variables using relevant expressions and sketches of their distribution and density functions. (7M)

3. a) State and prove Chebychev's inequality. (7M)
   b) Write notes on monotonic transformations for a continuous random variable. (7M)

4. a) Explain central limit theorem with equal and uneual distributions. (7M)
   b) Define joint distribution function of random variables and write its properties (7M)

5. a) What is random process? Explain Gaussian random process (7M)
   b) Define autocorrelation function of a random process and write its properties (7M)

6. a) Define power density spectrum and write down its properties. (7M)
   b) Define cross power density spectrum. List out its properties. (7M)

7. a) List out the properties of band-limited random process. (7M)
   b) Write short notes on thermal noise. (7M)

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Time: 3 hours Max. Marks: 70

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2. Answer **ALL** the question in **Part-A**
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PART –A

[7 x 2 =14]

1. a) What are the applications of Poisson's random variable?
   b) State Chebychev's inequality
   c) List any three properties of jointly Gaussian random variables.
   d) Write the properties of Autocorrelation Function of Random Process
   e) Find whether given power spectrum $\cos^2(\omega)\exp(-8\omega^2)$ is valid or not.
   f) List the properties of narrowband random process.
   g) What is mean value of output response of LTI system?

PART –B

2. a) State and prove the properties of probability density function. (7M)
   b) A random variable X has $F_X(x) = (1-(1/4)e^{-cx})u(x)$. Find the value of 'c' and P[2<X<10] and P[X>10]. (7M)

3. a) State and prove properties of moment generating function.. (7M)
   b) Obtain the moment generating function for uniformly distributed random variable in the interval [c,d]. (7M)

4. a) Write short notes on jointly Gaussian random variables (7M)
   b) Gaussian random variables X and Y have first and second order moments m_{10}=-1.1, m_{20}=1.16, m_{01}=1.5,m_{02} =2.89,R_{XY}=-1.724. Find C_{XY}, ρ? (7M)

5. a) Define cross correlation function of a random process and write its properties. (7M)
   b) Explain with the help of relevant expressions about WSS and SSS of a random process. (7M)

6. a) Derive the relation between cross power spectrum and cross correlation function. (7M)
   b) If X(t) is a stationary process, find the power spectrum of Y(t)= A_0+ B_0 X(t)in term of the power spectrum of X(t) if A_0 and B_0 are real constants (7M)

7. a) If white noise with power density 6(10-3)W/Hz is applied to the input, find the noise power in the system's output ? (7M)
   b) Derive the expression for average noise figure of cascaded two port networks (7M)

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Code No: R1621045 **R16** SET - 3

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(Electronics and Communications Engineering)

Time: 3 hours Max. Marks: 70

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2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

[7 x 2 =14]

1. a) Define mixed random variable and give an example.
   b) Show that the first central moment is zero.
   c) Write properties of Joint Density Function
   d) Distinguish between deterministic and non-deterministic random processes.
   e) Write the properties of power density spectrum
   f) What are the causes of thermal noise?
   g) Determine the mean value of uniform random variable.

PART -B

2. a) Two dice are thrown. The square of the sum of the points appearing on the two dice is a random variable X. Determine the values taken by X, and the corresponding probabilities. (7M)
   b) Distinguish between discrete, continuous and mixed random variables with suitable examples.

3. a) What is meant by expectation? State and prove its properties. (7M)
   b) Let Y=2X+3, If the random variable is uniformly distributed over [-1, 2], determine $f_y(y)$. (7M)

4. a) Write notes on linear transformation of Gaussian random variables (7M)
   b) Let Z is the sum of two independent random variables X and Y. Find the PDF of Z (7M)

5. a) Give the classification of random processes. (7M)
   b) List all the properties of auto-correlation function. F , where F is a random variable (7M)

6. a) Derive the expression for cross power density spectrum of a random process (7M)
   b) Derive the relationship between cross correlation and cross spectral density of random processes. (7M)

7. a) Obtain the expression for power density spectrum of an LTI system excited by a (7M)
   b) Derive the expression for effective noise temperature of cascaded system in terms of its individual input noise temperature. (7M)

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Code No: R1621045 **R16** SET - 4

II B. Tech I Semester Model Question Paper Sept - 2017
RANDOM VARIABLES AND STOCHASTIC PROCESSES
(Electronics and Communications Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

[7 x 2 =14]

1. a) Give example for continuous random variable and discrete random variable.
   b) What is Transformation? Classify the different types Transformation of Random Variable
   c) Define marginal probability density functions.
   d) State the conditions for a WSS random process.
   e) Relation Between Power Density Spectrum And Autocorrelation Function
   f) Draw power spectrum of a band limited process.
   g) Define generalized Nyquist theorem.

PART -B

2. a) Explain about the distribution and density functions of exponential RV with neat sketches (7M)

   b) Define conditional probability distribution function and write the properties (7M)

3. a) State and prove the properties of variance of a random variable. (7M)

   b) Let X be a random variable which can take on the values 1,2 and 3 with respective probabilities 1/3, 1/6, 1/2. Find its third moment about the mean. (7M)

4. a) List all the properties of jointly Gaussian random variables (7M)
   b) State central limit theorem for the following cases:
   i) Equal distributions ii) Unequal distributions (7M)
   Determine $f_Z(Z)$ in terms of $f_X(X)$ and $f_Y(Y)$, if Z=X+Y

5. a) Derive an expression that relates autocorrelation function and auto covariance function. (7M)
   b) D. A random process is given by X(t)=at+b, where b is a constant and a is an r.v uniformly distributed in the range (-2, 2). Is the process WSS? (7M)

6. a) Show that the autocorrelation function and power spectral density forms Fourier transform pair. (7M)
   b) Show that the power spectrum of a real random process X(t) is real. (7M)

7. a) Explain the terms effective noise temperature, noise figure. (7M)
   b) Write notes on the following terms: i) Thermal noise ii) Narrowband noise (7M)
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