JNTUA UNIVERSITY
PREVIOUS QUESTION PAPERS

Code: 9A04303 **SS/AS**

B.Tech II Year I Semester (R09) Supplementary Examinations June 2015

PROBABILITY THEORY & STOCHASTIC PROCESSES

(Common to ECE and EEE)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions
All questions carry equal marks
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1 (a) State and prove Bayes's Theorem.
(b) A missile can be accidentally launched if two relays A and B both have failed. The probabilities of A and B failing are known to be 0.01 and 0.03 respectively. It is also known that B is more likely to fail (probability 0.06) if A failed.
(i) What is the probability of an accidental missile launch?
(ii) What is the probability that A will fail if B has failed?
(iii) Are events "A fails" and "B fails" statistically independent?

2 (a) Find the movement generating function of a uniform distribution and hence find its mean obtain the mean.
(b) Obtain mean value of a sum of N weighted random variables. Also define joint moments about the origin.

3 (a) Consider a random process x(t) = Ucos t+Vsin t, where U and V are independent random variables each of which assumes values -2 and 1 with probabilities 1/3 and 2/3 respectively. Show that x(t) is WSS and not SSS.
(b) Explain Chebychev's Inequality.

4 (a) A random process is defined as X (t) = A cos (πt). Where A is a Gaussian random variable with zero mean and variance ${\sigma_A}^2$.
(i) Find the density functions X(0) and X(1).
(ii) Is X(t) stationary in any sense?
(b) What are the axioms of probability? Give engineering examples.

5 (a) List the properties of N random variable.
(b) In a control system, a random voltage X is known to have a mean value of -2V and a second moment of $9V^2$. If the voltage X is amplified by an amplifier that gives an output Y = 1.5 X + 2, find the variance of Y.

6 (a) Explain the concept and classification of stochastic process.
(b) Derive the relation between cross power density spectrum and cross correlation function of a random process.

7 (a) Define in-phase component and quadrature-phase component.
(b) Obtain an expression to find noise band width of the system.

8 Write short notes on the following:
(a) Relationship between power spectrum and autocorrelation function.
(b) Poisson random process.

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Code: 9A04303

R09

B.Tech II Year II Semester (R09) Supplementary Examinations December/January 2015/2016

PROBABILITY THEORY & STOCHASTIC PROCESSES

(Electronics & Computer Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

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1 (a) When two dice are thrown, find the probability of getting the sums of 10 or 11?
(b) State and prove Baye's theorem.

2 (a) Define random variable and explain the concept of random variable.
(b) Define and explain Rayleigh density function.

3 (a) Explain the following terms:
(i) Variance. (ii) Skew.
(b) The density function of a random variable X is $f_X(x) = \begin{cases} 5e^{-5x}, & 0 \le x \le \infty \\ 0 & elsewhere \end{cases}$
Find: (i) E[X]. (ii) E[(X-1)^2].

4 (a) Define vector random variable.
(b) Explain the properties of joint distribution.
(c) The joint density function of the random variables X and Y is given as;
$f_{XY}(x, y) = 8\,xy$ for $0 \le x \le 1, \quad 0 \le y \le x$
$= 0 \quad otherwise$
Find the marginal density of X.

5 (a) X and Y are independent random variables having density function
$f_X(x) = 2e^{-2x}$ for $x \ge 0$
$= 0 \quad otherwise$
And
$f_Y(y) = 2e^{-2y}$ for $y \ge 0$
$= 0 \quad otherwise$
Find (i) E[X+Y] and (ii) E[XY]
(b) Explain how to obtain the pdf of two functions of two random variables.

6 (a) Explain the concept of stochastic process.
(b) Distinguish between deterministic and non deterministic processes.
(c) What is the difference between random sequence and random process?

7 (a) List the properties of autocorrelation function.
(b) Explain in detail about Poisson random process.

8 (a) Prove that PSD and autocorrelation function of a random process form a Fourier transform pair.
(b) Find the autocorrelation function and power spectral density of the random process, $x(t) = K\cos(\omega_0 t + \theta)$ where θ is a random variable over the ensemble and is uniformly distributed over the range $(0, 2\pi)$.

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Code: 9A04303

AS

B.Tech II Year I Semester (R09) Supplementary Examinations December 2014

PROBABILITY THEORY & STOCHASTIC PROCESSES

(Electronics & Communication Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions
All questions carry equal marks

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1 (a) A bag contains 4 balls. Two balls are drawn and are found to be white. Find the probability that all balls are white.
(b) Discuss joint and conditional probabilities.
(c) Define discrete sample space.

2 (a) Explain the Rayleigh probability density function.
(b) A random variable 'X' has the density function $f_X(X) = k\frac{1}{1+x^2}, -\infty < X < \infty$.
$= 0, otherwise$
Determine 'k' and the distribution function.

3 (a) Let 'X' be the random variable defined by the density function:
$f_X(X) = \frac{5}{4}(1 - X^4), 0 < x \leq 1.$
$= 0, otherwise$
Find E[X], E[X^2] and variance.
(b) Briefly explain about characteristic function.

4 (a) Explain the importance of central limit theorem.
(b) Let $f_{XY}(x, y) = x + y, for\ 0 \leq x \leq 1, 0 \leq y \leq 1$
$= 0, otherwise$
Find the conditional density of the following:
(i) X given Y.
(ii) Y given X.

5 (a) X and Y are independent random variables each having density function of the form:
$f_U(U) = 2e^{-2u}, for\ u \geq 0$
$= 0, otherwise.$
Find the following:
(i) E[X+Y].
(ii) E[X^2+Y^2].
(iii) E[XY].
(b) Briefly explain the joint moments about the origin.

6 (a) A random process defined as $x(t) = A\,sin(\omega t + \theta)$, where A is a constant and θ is a random uniformly distributed over $(-\pi, \pi)$. Check $x(t)$ for stationarity.
(b) Explain when the two different random processes are called statistically independent.

7 (a) Discuss Gaussian random process in detail.
(b) Define and explain covariance and its properties.

8 (a) Discuss the spectral characteristics of system response.
(b) Explain the concept of power spectral density.

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Code :RA 9A04303 **RA**

II B.Tech I semester (R09) Regular Examinations, November 2010
PROBABILITY THEORY & STOCHASTIC PROCESSES
(Electrical & Electronics Engineering)
(For students of R07 regulation readmitted to II B.Tech I semester R09)

Time: 3 hours **Max Marks: 70**

Answer any FIVE questions
All questions carry equal marks
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1. (a) Distinguish between mutually exclusive events & independent events.
   (b) Define the following and give one example for each.
      i. Sample space
      ii. Event
      iii. Mutually exclusive events
      iv. Collective by exclusive events.

2. (a) If the pdf of a random variable is given by
   $f(x) = k(1 - x^2), for 0 < x < 1$
   $= o \ elsewhere.$
   Find the value of k and the probability that it will take a value
   i) Between 0.1 and 0.2
   ii) Greater than 0.5
   (b) Find the mean and characteristic function of binomial distribution.

3. (a) For the random variable 'x' whose density function is
   $f(x) = \frac{1}{b-a} \quad a \le x \le b$
   =0 otherwise. Determine
   (i) Moment generating function
   (ii) Mean and variance.
   (b) The random variable x has characteristic function given by
   $\varphi(t) = 1 - (t), (t) \le 1$
   $= 0, (t) > 1$
   Find the density function of random variable X.

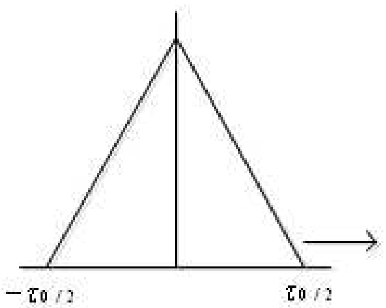
4. (a) If X and Y are independent random variables having density functions
   $f_1(x) = \begin{cases} 2e^{-2x} & x \ge 0 \\ 0 & x < 0 \end{cases} \ f_2(y) = \begin{cases} 3e^{-3y} & y \ge 0 \\ 0 & y < 0 \end{cases}$
   Find the density function of their sum V=X+Y.
   (b) If X and Y are two random variables which are Guassian. If a random variable z is defined as Z=X+Y. find$f_z(z)$

5. (a) Two random variables X and Y have the joint characteristic function
   $\varphi_{xy} = (w_1, w_2) = e - 2w_1^2 - 8w_2^2$. Show that X and Y are both zero mean random variables and also that they are uncorrelated.
   (b) Define two joint central moments for two dimensional random variable X and Y.

6. (a) Let z(t)=x(t) cost (w_0t +y), where x(T) is a zero mean stationary Guassian random process with $E(x^2(t)) = \sigma_x^2$
      i. If Y is constant, say zero find $E(z^2(t)); z(t)$ stationary.
      ii. If Y is random variable with a uniform pdf in the interval $(-\pi, \pi)$. find $R_{zz}(t, t + 7)$. Is z(t) wide sense stationary, if so, find the PSD of z(t).
   (b) State the condition for wide sense stationary random process.

7. (a) An ergodic random process is known to have an auto correlation function of the form.
$R_{xx}(\tau) = 1 - |\tau|, |\tau| \leq 1$
$= 0, |\tau| > 1$
Show the spectral density which is given by
$S_{xx}(w) = \left[\frac{\sin w/2}{w/2}\right]^2$

(b) Find the auto correlation function for white noise, shown in the figure below.



8. (a) Prove that PSD and ACF of random process form a fourier transform pair.
(b) State and prove Bayer theorem of probability.

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Code: 9A04303

SS

B.Tech II Year I Semester (R09) Supplementary Examinations June 2016

PROBABILITY THEORY & STOCHASTIC PROCESS

(Electrical & Electronics Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

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1 (a) A Gaussian random variable has mean value 1 and variance of 4. Find the probability that random variable has value between 1 and 2.

(b) A random variable X has a probability density function of the form: $f_x(x) = \frac{1}{4}[u(x) - u(x-1)]$ for the random variable Y = X^2, find the variance.

2 (a) Define joint distribution function and write its properties.

(b) State and prove central limit theorem for equal distributions.

3 (a) Classify different types of random processes.

(b) Write short notes on transformation of multiple random variables.

4 (a) Define auto and cross correlation function and write its properties.

(b) Find distribution and density functions of sum of two random variables.

5 (a) Given random process $X(t) = A\cos\omega_0 t + B\sin\omega_0 t$, where ω_0 is a constant and A & B are uncorrelated zero mean random variables having different density functions but the same variance σ^2. Show that X(t) is wide sense stationary but not strict sense stationary.

(b) Define cross covariance and list out its properties.

6 (a) Show that the linear transformation of a Gaussian random variable produces Gaussian random variable with Y = aX + b.

(b) Find the probability of the event $\{X \leq 5.5\}$ for Gaussian random variable having $a_X = 3$ and $\sigma_X = 2$.

7 (a) The sample space of an experiment is S = {0, 1, 2, 5, 6}. List all the possible values of the random variables defined as, X = 2S, X = $5S^2$ - 1.

(b) Explain the effective noise temperature and average noise figure.

8 (a) Define conditional distribution function and explain its properties.

(b) Explain quantitatively the mean and mean square value of a system response.

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Code: 13A04304 **R13**

B.Tech II Year I Semester (R13) Supplementary Examinations November/December 2017

PROBABILITY THEORY & STOCHASTIC PROCESSES

(Electronics & Communication Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Compute the probability of the event "getting a queen card" from a deck of 52 cards.

(b) Express the density and distribution function of uniform random variable.

(c) Examine the joint density function $f_{XY}(x,y) = \begin{cases} \frac{1}{24}, & 0 \leq x \leq 6, 0 \leq y \leq 4 \\ 0, & elsewhere \end{cases}$ is valid or not.

(d) If V = -X-Y, & W = 2X+Y then find correlation of V & W, where X & Y are independent with E(X) = 1, E(Y) = 1, Var(X) = 4, Var(Y) = 2.

(e) Define the random process with one example.

(f) Evaluate the variance of X(t), if its autocorrelation is $R_{XX}(\tau) = 36 + \frac{16}{1+8\tau^2}$.

(g) Verify $S_{XX}(\omega) = \frac{\omega^2}{\omega^6+3\omega^2+3}$ is valid or not.

(h) Write the expression for average power P_{XX} in X(t) in time domain.

(i) What is the output PSD of a system response $S_{YY}(\omega)$.

(j) Define the thermal noise.

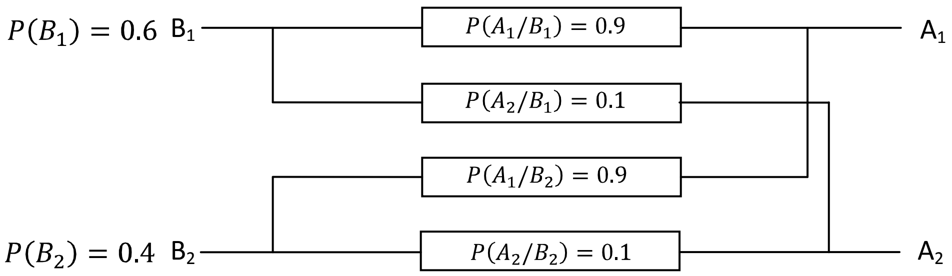
PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) A binary communication channel carries data as one of two types of signals denoted by 0 and 1. Owing to noise a transmitted 0 is sometimes received as 1 and transmitted 1 is sometimes received as 0. Determine the following based on the data given below.

(i) Probability that 1 is received.
(ii) Probability that 0 is received.
(iii) Probability that a 1 was transmitted, given that a 1 was received.
(iv) Probability that a 0 was transmitted, given that a 0 was received.
(v) Probability of system error.



(b) Define probability density function. Prove its properties.

OR

3 (a) Give the classical definition of probability. Discuss joint probability and conditional probability with an example.

(b) Briefly explain the Gaussian density and distribution function with plots. Determine the probability of the event $\{X \leq 7.3\}$, if Gaussian random variable having $a_X = 7$ and $\sigma_X = 0.5$.

Contd. in page 2

UNIT – II

4 Two random variables X and Y have the joint PDF.

$$f_{XY}(x,y) = Ae^{-(2x+y)}, \quad x,y \ge 0$$
$$0, \quad otherwise$$

Evaluate: (i) Constant A. (ii) Marginal pdf's $f_X(x)$ & $f_Y(y)$. (iii) Joint CDF $f_{XY}(x,y)$. (iv) Marginal CDF's $F_X(x)$ & $F_Y(y)$. (v) Conditional pdf's $f_X(x/y)$ & $f_Y(y/x)$.

OR

5 (a) Justify the statement "The density function of the sum of two statistically independent random variables is the convolution of their individual density functions".

(b) Let X & Y be statically independent random variables with $\bar{X} = \frac{3}{4}, \overline{X^2} = 4, \bar{Y} = 1, \overline{Y^2} = 5$. For a random variable W = X-2Y+1, then calculate: (i) R_{XY}. (ii) R_{XW}. (iii) R_{YW}. (iv) C_{XY} and verify X & Y are uncorrelated or not.

UNIT – III

6 (a) Briefly introduce the concept of random process and categorize its classifications with one example to each one.

(b) Given $\bar{X} = 6$ and $R_{XX}(t, t+\tau) = 36 + 25\exp(-\tau)$ for a random process X(t). Indicate which of the following statements true and mention reasons also.
(i) Is first order stationary? (ii) Has total average power of 61 W. (iii) Is ergodic. (iv) Is wide sense stationary? (v) Has a periodic component. (vi) Has an AC power of 36 W.

OR

7 (a) Check the given stationary random process $X(t) = 10\cos(100t + \theta)$, where θ is a random variable with a uniform probability distribution in the interval $(-\pi, \pi)$ is WSS or not.

(b) State and prove the properties of autocorrelation function of random process.

UNIT – IV

8 Two independent random process X(t) & Y(t) have power spectrum densities $S_{XX}(\omega) = \frac{16}{\omega^2+16}$ and $S_{YY}(\omega) = \frac{\omega^2}{\omega^2+16}$ respectively with zero means. Let another random process U(t) = X(t) + Y(t). Then find: (i) PSD of U(t). (ii) $S_{XY}(\omega)$. (iii) $S_{XU}(\omega)$. (iv) $S_{YU}(\omega)$.

OR

9 (a) Write the expression for auto power spectral density of random process X(t) and prove the following:
(i) $S_{\dot{X}\dot{X}}(\omega) = \omega^2 S_{XX}(\omega)$. (ii) $S_{XX}(-\omega) = S_{XX}(\omega)$ where $\dot{X}(t) = \frac{d}{dt}(X(t))$.

(b) Derive the relation between the cross correlation function and cross power spectral density of random processes X(t) & Y(t).

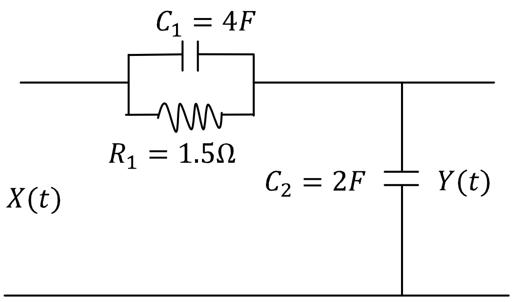
UNIT – V

10 (a) Deduce the equation for auto PSD of system response $S_{YY}(\omega)$.

(b) Determine the mean value of system response has $h(t) = e^{-Wt}, \ t > 0$; $0, \ t < 0$ and $R_{XX}(\tau) = A^2 + B\exp(-|\tau|)$, where A, B are constants.

OR

11 A stationary random process X(t) having autocorrelation function $R_{XX}(\tau) = 2\exp(-4|\tau|)$ is applied to the network shown in figure below. Calculate (i) $S_{XX}(\omega)$ (ii) $|H(\omega)|^2$ (iii) $S_{YY}(\omega)$.



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Code: 13A04304

R13

B.Tech II Year I Semester (R13) Regular Examinations December 2014

PROBABILITY THEORY & STOCHASTIC PROCESSES

(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

*****

1 Answer the following: (10 X 02 = 20 Marks)

(a) State Baye's theorem.

(b) Three coins are tossed in succession. Find out the probabilities of occurrence of two consecutive heads.

(c) State central limit theorem.

(d) Find the expected value of the face value while rolling fair die?

(e) Define cross-covariance function.

(f) Give any two examples for poisson random process.

(g) A random process has the power density spectrum $S_{XX}(\omega) = \frac{6\omega^2}{1+\omega^4}$. Find the average power in the process.

(h) What is power spectral density? Mention its importance.

(i) Define the following random process: (i) Band limited. (ii) Narrow band.

(j) What are the two conditions that are to be satisfied by the power spectrum $\frac{\omega^2}{\omega^6+3\omega^2+3}$ to be a valid power density spectrum?

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT - I

2 (a) A pack contains 4 white and 2 green pencils, another contains 3 white and 5 green pencils. If one pencil is drawn from each pack, find the probability that (i) Both are white. (ii) One is white and another is green

(b) Explain about joint and conditional probability.

OR

3 (a) Consider the experiment of tossing four fair coins. The random variable X is associated with the number of tails showing. Compute and sketch the CDF of X.

(b) Define probability density function. List its properties.

UNIT - II

4 (a) Let X and Y be jointly continuous random variables with joint density function

$f_{XY}(x,y) = xy\, e^{-\left(\frac{x^2+y^2}{2}\right)}$; for x>0, y>0

$= 0$; otherwise

(i) Check whether x and y are independent.

(ii) Find P (x≤1, y≤1).

(b) How expectation is calculated for two random variables?

OR

5 (a) Prove the following:

Var (ax+by) = a^2 var(x) + b^2 var(y) + 2ab cov(x,y)

(b) Explain central limit theorem.

Contd. in page 2

UNIT - III

6 (a) Explain about mean-ergodic process.

(b) If x (t) is a stationary random process having mean = 3 and auto correlation function: $R_{XX}(\tau) = 9 + 2e^{-|\tau|}$. Find the mean and variance of the random variable.

OR

7 (a) Explain the significance of auto correlation.

(b) Find auto correlation function of a random process whose power spectral density is given by $\frac{4}{1+\frac{\omega^2}{4}}$

UNIT – IV

8 (a) Briefly explain the concept of cross power density spectrum.

(b) Find the cross correlation of functions sin ωt and cos ωt.

OR

9 (a) The power spectral density of a stationary random process is given by

$$S_{XX}(\omega) = \begin{cases} A; & -k < \omega < k \\ 0; & \text{otherwise} \end{cases}$$

Find the auto correlation function.

(b) Discuss the properties of power spectral density.

UNIT – V

10 (a) A Gaussian random process X (t) is applied to a stable linear filter. Show that the random process Y(t) developed at the output of the filter is also Gaussian.

(b) Discuss about cross correlation between the input X (t) and output Y (t).

OR

11 (a) Derive the relation between PSDs of input and output random process of an LTI system.

(b) The input voltage to an RLC series circuit is a stationary random process X(t) with E[X (t)] = 2 and $R_{XX}(\tau) = 4 + \exp(-2|\tau|)$. Let Y (t) is the voltage across capacitor. Find E[Y(t)] .

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Code: 13A04304 **R13**

B.Tech II Year I Semester (R13) Supplementary Examinations November/December 2016

PROBABILITY THEORY & STOCHASTIC PROCESSES

(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

*****

1 Answer the following: (10 X 02 = 20 Marks)

(a) What is the condition for a function to be a random variable?
(b) Define Gaussian random variable.
(c) How interval conditioning is different from point conditioning?
(d) When N random variables are said to be jointly Gaussian?
(e) Explain about strict-sense stationery processes.
(f) Where the Poisson random processes is used? Explain.
(g) Examine the function $\frac{\omega^2}{\omega^6 + 3\omega^2 + 3}$ for valid PSD.
(h) Correlate CPSD and CCF.
(i) Analyze the power density spectrum of response.
(j) List the properties of band limited processes.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) Give Classical and Axiomatic definitions of Probability.
(b) In a single through of two dice, what is the probability of obtaining a sum of at least 10?

OR

3 (a) What is the concept of Random Variable? Explain with a suitable example.
(b) A random variable X has the distribution function:

$$F_X(x) = \sum_{n=1}^{12} \frac{n^2}{650} u(x-n)$$

Find the probabilities (i) P{-∞< X ≤ 6.5}. (ii) P{X > 4} (iii) P{6 < X ≤ 9}.

UNIT – II

4 (a) State and explain the central limit theorem.
(b) Given the function:

$$f_{XY}(x, y) = \begin{cases} b(x + y)^2, & -2 < x < 2, -3 < y < 3 \\ 0, & \text{elsewhere} \end{cases}.$$

(i) Find a constant 'b' such that this is a valid density function.
(ii) Determine the marginal density functions $f_x(x)$ and $f_y(y)$.

OR

5 (a) What are the properties of Jointly Gaussian Random variables?
(b) A random variable X has $\overline{X} = -3, \overline{X^2} = 11, and \sigma_x^2 = 2$. For a new random variable Y= 2X-3, find: (i) $\overline{Y}$. (ii) $\overline{Y^2}$. (iii) σ_y^2.

Contd. in page 2

UNIT – III

6 (a) List and explain various properties of Autocorrelation function.

(b) Given the Autocorrelation function of the processes:

$$R_{XX}(\tau) = 25 + \frac{4}{1 + 6\tau^2}$$

Find the mean and variance of the process X(t).

OR

7 (a) Compare the Cross Correlation Function with Autocorrelation function.

(b) Assume that an Ergodic random process X(t) has an autocorrelation function:

$$R_{XX}(\tau) = 18 + \frac{2}{6 + \tau^2}[1 + 4\cos(12\tau)]$$

(i) Find $|\overline{X}|$. (ii) Does this process have periodic component? (iii)What is the average power in X(t)?

UNIT – IV

8 (a) State and explain the Wiener-Khintchine relation.

(b) Obtain the auto correlation function corresponding to the power density spectrum:

$$S_{XX}(\omega) = \frac{8}{(9 + \omega^2)^2}$$

OR

9 (a) Define Power Spectral Density? List out its properties.

(b) Compute the average power of the process having power spectral density $\frac{6\omega^2}{1+\omega^4}$.

UNIT – V

10 (a) What is LTI system? How the response can be obtained from LTI system.

(b) Find the system response, when a signal x(t)= u(t) e^{-2t} is applied to a network having an impulse response h(t) = 3u(t) e^{-3t}.

OR

11 (a) Explain about mean and mean square value of system response?

(b) A random process X(t) is applied to a network with impulse response: h(t) = u(t) t e^{-3t}. The cross correlation of X(t) with the output Y(t) is known to have the same form $R_{XX}(\tau) = u(\tau)\,\tau\, e^{-3\tau}$.

(i) Find the autocorrelation of Y(t).

(ii)What is the average power in Y(t)

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Code: 13A04304 **R13**

B.Tech II Year I Semester (R13) Supplementary Examinations June 2016

PROBABILITY THEORY & STOCHASTIC PROCESSES

(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

*****

1 Answer the following: (10 X 02 = 20 Marks)

(a) Clearly explain about certainty and uncertainty with suitable examples.

(b) What is the condition for a function to be a random variable?

(c) When N random variables are said to be jointly Gaussian?

(d) How interval conditioning is different from point conditioning?

(e) What is stationery processes? Explain.

(f) Test the function "$e^{-\tau} u(\tau)$" for a valid ACF.

(g) Examine the function "$\dfrac{\omega^2}{\omega^6 + 3\omega^2 + 3}$" for valid PSD.

(h) Define power spectral density.

(i) Analyze the power density spectrum of response.

(j) Explain about mean square value of system response.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 A random variable X has the distribution function:

$$F_X(x) = \sum_{n=1}^{12} \frac{n^2}{650} u(x-n)$$

Find the probabilities: (i) P{-∞ < X ≤ 6.5}. (ii) P{X > 4}. (iii) P{6 < X ≤ 9}.

OR

3 For the random variable X whose density function is:

$$f(x) = \begin{cases} \dfrac{1}{b-a}, & a \le x \le b \\ 0, & \text{Otherwise} \end{cases}$$

Determine Mean and Variance.

UNIT – II

4 Given the function:

$$f_{XY}(x, y) = \begin{cases} b(x + y)^2, & -2 < x < 2, -3 < y < 3 \\ 0, & \text{elsewhere} \end{cases}.$$

(i) Find a constant b such that this is a valid density function.

(ii) Determine the marginal density functions $f_x(x)$ and $f_y(y)$.

OR

5 A random variable X has $\overline{X} = -3$, $\overline{X^2} = 11$ and $\sigma_x^2 = 2$. For a new random variable Y= 2X-3, find: (i) $\overline{Y}$ (ii) $\overline{Y^2}$ (iii) σ_y^2.

Contd. in page 2

UNIT – III

6 What is ACF? State and explain any four properties of ACF.

OR

7 Explain about first order, second order, wide-sense and strict-sense stationery processes.

UNIT – IV

8 Find the auto correlation function corresponding to the power density spectrum:

$$S_{XX}(\omega) = \frac{157 + 12\omega^2}{(16 + \omega^2)(9 + \omega^2)}$$

OR

9 What is PSD? State and explain any four properties of PSD.

UNIT – V

10 X(t) is stationary random process with zero mean and auto correlation function $R_{XX}(\tau)=e^{-2|\tau|}$ is applied to a system of function: $H(\omega) = \frac{1}{2 + j\omega}$. Find Power Spectral Density of its output

OR

11 A random process X(t) is applied to a network with impulse response $h(t) = u(t)\, t\, e^{-bt}$, where $b > 0$ is a constant. The cross correlation of X(t) with the output Y(t) is known to have the same form $R_{XX}(\tau) = u(\tau)\, \tau\, e^{-b\tau}$.

(i) Find the autocorrelation of Y(t).

(ii) What is the average power in Y(t)?

*****

Code: 13A04304

R13

B.Tech II Year I Semester (R13) Regular & Supplementary Examinations December 2015

PROBABILITY THEORY & STOCHASTIC PROCESSES

(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

*****

1 Answer the following: (10 X 02 = 20 Marks)

(a) What are the conditions to be satisfied for the statistical independence of three events A, B and C?

(b) Show that $P(x_1 < X \leq x_2) = F_X(x_2) - F_X(x_1)$.

(c) Two random variables X and Y have the following values:

$E[X] = E[Y] = \frac{7}{12}, E[XY] = \frac{1}{3}$ and $\sigma_X = \sigma_Y = \sqrt{\frac{11}{144}}$. Find the correlation coefficient.

(d) Define the joint moments about the origin.

(e) Define WSS random process.

(f) Determine the mean-square value of a random process with autocorrelation function: $R_{XX}(\tau) = e^{-|\tau|}$.

(g) A random process has the power density spectrum $S_{XX}(\omega) = \frac{6\omega^2}{1+\omega^4}$. Find the average power in the process.

(h) Define rms bandwidth of the power spectrum.

(i) Impulse response of a linear system is $h(t) = [1-t][u(t) - u(t-1)]$. The input to this system is a sample function from a random process having an autocorrelation function of $R_{XX}(\tau) = \delta(\tau)$. Find the autocorrelation of the output.

(j) A stationary random process with a mean of 2 is passed through an LTI system with $h(t) = 2e^{-2t}\,u(t)$. Determine the mean of the output process.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) Define conditional distribution and density functions and list their properties.

(b) A continuous random variable X has a PDF $f_X(x) = 3x^2,\ 0 \leq x \leq 1$. Find ‘a’ and ‘b’ such that:
(i) $P\{X \leq a\} = P\{X > a\}$. (ii) $P\{X > b\} = 0.05$.

OR

3 (a) Define random variable and give the concept of random variable with an example.

(b) The probability density function of a random variable has the form $f_X(x) = 5e^{-kx}u(x)$, where $u(x)$ is the unit step function. Find the probability that $X > 1$.

UNIT – II

4 (a) Define marginal density and distribution functions.

(b) Let X and Y be jointly continuous random variables with joint probability density function:

$$f_{XY}(x,y) = x^2 + \frac{xy}{3}; \quad 0 \leq x \leq 1, 0 \leq y \leq 2$$
$$= 0 \quad ; \quad elsewhere$$

Find: (i) $f_X(x)$. (ii) $f_Y(y)$. (iii) Are X and Y independent?

OR

5 (a) State central limit theorem for the following two cases:
(i) Equal distributions. (ii) Unequal distributions.

(b) Let $f_{XY}(x,y) = 4x + 2y,\ 0 \leq x \leq 1/2,\ 0 \leq y \leq 1$ and zero elsewhere. Find $P\{X \leq 1/4\}$.

Contd. in page 2

UNIT – III

6 (a) A random process has sample functions of the form: $X(t) = \begin{cases} A; & 0 \le t \le 1 \\ 0; & else\ where \end{cases}$

Where A is a random variable uniformly distributed from 0 to 10. Find the autocorrelation function of this process.

(b) Show that $|R_{XX}(\tau)| \le R_{XX}(0)$.

OR

7 (a) Show that the autocorrelation function of a stationary random process is an even function of τ.

(b) Give the classification of random processes.

UNIT – IV

8 (a) A stationary random process has a two-sided spectral density given by:

$$S_{XX}(f) = \begin{cases} 10; & a < |f| < b \\ 0; & else\ where \end{cases}$$

Find the mean-square value of the process if $a = 4$ and $b = 5$.

(b) List the properties of power spectral density function.

OR

9 (a) For two jointly stationary random processes, the cross-correlation function is $R_{XY}(\tau) = 2e^{-2\tau}u(\tau)$. Find the two cross-spectral density function.

(b) List the properties of cross power spectral density function.

UNIT – V

10 Show that $R_{YY}(\tau) = R_{XX}(\tau) * h(\tau) * h(-\tau)$.

OR

11 Write short notes on the following:

(a) Bandpass random process.

(b) Band-limited random process.

*****

Code: 13A04304

R13

B.Tech II Year I Semester (R13) Supplementary Examinations June 2015

PROBABILITY THEORY & STOCHASTIC PROCESSES

(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

*****

1 Answer the following: (10 X 02 = 20 Marks)

(a) State the properties of conditional density function.

(b) What is the importance of Rayleigh distribution function?

(c) The joint density function of two discrete random variables X and Y is:

$f_{XY}(x,y) = k\,xy$; for $0 < x < 4,\ 1 < y < 5$

$= 0$; otherwise

Find the value of the constant k.

(d) Define joint characteristic functions of two random variables.

(e) Distinguish between stationary and non-stationary random process.

(f) When two different random processes are said to be statistically independent?

(g) If the PSD of x(t) is $S_{XX}(\omega)$. Find the PSD of $\frac{d\,x(t)}{dt}$.

(h) State any two differences between random variable and random process.

(i) A wide sense stationary random process x(t) is applied to the input of an LTI system whose impulse response is $5t\,e^{-2t}$. The mean of x(t) is 3. Find the mean output of the system.

(j) Give any two spectral characteristics of the system response.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) Define and explain the concept of random variable.

(b) Determine whether the following is a valid distribution function or not.

$F(x) = 1 - e^{-x/2};\quad for\ x \geq 0$

$= 0\quad ;\ elsewhere$

(OR)

3 (a) How do you explain statistically independent events using Baye's rule?

(b) A bag contains four balls. Two balls are drawn and are found to be white. Find the probability that all the balls are white.

UNIT – II

4 (a) Discuss the properties of conditional distribution function.

(b) If the joint PDF of two dimensional random variable (x, y) is given by:

$f_{XY}(x,y) = 2$; for $0 < x < 1,\ 0 < y < x$

$= 0$; otherwise

Find the marginal density function of X and Y.

(OR)

5 (a) Random variables X and Y have the joint density:

$f_{XY}(x,y) = \frac{1}{24}$; for $0 < x < 6\ and\ 0 < y < 4$

$= 0$; elsewhere

What is the expected value of the function $g(X,Y) = (X,Y)^2$?

(b) Briefly explain about jointly Gaussian random variables.

Contd. in page 2

UNIT – III

6 (a) Distinguish between ensemble average and time average of a random process.

(b) A random process is defined as x(t) = A sin$(\omega t + \theta)$, where A is a constant and θ is a random variable uniformly distributed over $(-\pi, \pi)$. Check x(t) for stationarity.

(OR)

7 (a) State and prove any three properties of auto correlation function.

(b) When do you call two random processes to be jointly wide sense stationary?

UNIT – IV

8 (a) Discuss the properties of cross-power density spectrum.

(b) Find the PSD of a stationary random process for which auto correlation is $R_{XX}(\tau) = 6e^{-\alpha|\tau|}$.

(OR)

9 (a) If V(f) = AT sin$\frac{(2\pi f t)}{2\pi f t}$, find the energy contained in v(t).

(b) Discuss the relationship between cross power spectrum and cross correlation function.

UNIT – V

10 (a) How mean value of the system response y(t) is calculated?

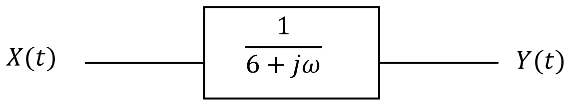
(b) Discuss the transmission of random process through linear system.

(OR)

11 (a) Discuss the following random process:

(i) Band pass. (ii) Band limited. (iii) Narrow band.

(b) Consider a linear system a shown below:



X(t) is the input and Y(t) is the output of the system. The auto correlation of X(t)is $R_{XX}(\tau) = 3\delta(\tau)$. Find the PSD, auto correlation function of the output Y(t).

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Code: 13A04304

R13

B.Tech II Year I Semester (R13) Regular Examinations December 2014

PROBABILITY THEORY & STOCHASTIC PROCESSES

(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

*****

1 Answer the following: (10 X 02 = 20 Marks)

(a) State Baye's theorem.

(b) Three coins are tossed in succession. Find out the probabilities of occurrence of two consecutive heads.

(c) State central limit theorem.

(d) Find the expected value of the face value while rolling fair die?

(e) Define cross-covariance function.

(f) Give any two examples for poisson random process.

(g) A random process has the power density spectrum $S_{XX}(\omega) = \frac{6\omega^2}{1+\omega^4}$. Find the average power in the process.

(h) What is power spectral density? Mention its importance.

(i) Define the following random process: (i) Band limited. (ii) Narrow band.

(j) What are the two conditions that are to be satisfied by the power spectrum $\frac{\omega^2}{\omega^6+3\omega^2+3}$ to be a valid power density spectrum?

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT - I

2 (a) A pack contains 4 white and 2 green pencils, another contains 3 white and 5 green pencils. If one pencil is drawn from each pack, find the probability that (i) Both are white. (ii) One is white and another is green

(b) Explain about joint and conditional probability.

OR

3 (a) Consider the experiment of tossing four fair coins. The random variable X is associated with the number of tails showing. Compute and sketch the CDF of X.

(b) Define probability density function. List its properties.

UNIT - II

4 (a) Let X and Y be jointly continuous random variables with joint density function

$$f_{XY}(x,y) = xy\, e^{-\left(\frac{x^2+y^2}{2}\right)}; \text{ for } x>0,\ y>0$$
$$= 0; \text{ otherwise}$$

(i) Check whether x and y are independent.

(ii) Find P (x≤1, y≤1).

(b) How expectation is calculated for two random variables?

OR

5 (a) Prove the following:

$\text{Var}(ax+by) = a^2 \text{var}(x) + b^2 \text{var}(y) + 2ab\, \text{cov}(x,y)$

(b) Explain central limit theorem.

Contd. in page 2

UNIT - III

6 (a) Explain about mean-ergodic process.

(b) If x (t) is a stationary random process having mean = 3 and auto correlation function: $R_{XX}(\tau) = 9 + 2e^{-|\tau|}$. Find the mean and variance of the random variable.

OR

7 (a) Explain the significance of auto correlation.

(b) Find auto correlation function of a random process whose power spectral density is given by $\frac{4}{1+\frac{\omega^2}{4}}$

UNIT – IV

8 (a) Briefly explain the concept of cross power density spectrum.

(b) Find the cross correlation of functions sin ωt and cos ωt.

OR

9 (a) The power spectral density of a stationary random process is given by

$$S_{XX}(\omega) = A; \ -k < \omega < k$$
$$= 0; \text{ otherwise}$$

Find the auto correlation function.

(b) Discuss the properties of power spectral density.

UNIT – V

10 (a) A Gaussian random process X (t) is applied to a stable linear filter. Show that the random process Y(t) developed at the output of the filter is also Gaussian.

(b) Discuss about cross correlation between the input X (t) and output Y (t).

OR

11 (a) Derive the relation between PSDs of input and output random process of an LTI system.

(b) The input voltage to an RLC series circuit is a stationary random process X(t) with E[X (t)] = 2 and $R_{XX}(\tau) = 4 + \exp(-2|\tau|)$. Let Y (t) is the voltage across capacitor. Find E[Y(t)] .

*****

Code: 13A04304 **R13**

B.Tech II Year I Semester (R13) Supplementary Examinations June 2018

PROBABILITY THEORY & STOCHASTIC PROCESSES

(Electronics & Communication Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

*****

1 Answer the following: (10 X 02 = 20 Marks)

(a) If two events A and B are independent, prove that the events $\bar{A}$ and B are independent.
(b) Write the properties of conditional density function.
(c) Define marginal density functions.
(d) State central limit theorem.
(e) Define Gaussian random process.
(f) Given that autocorrelation function for a stationary ergodic process with a periodic component is $R_{XX}(\tau) = \frac{25\tau^2+36}{6.25\tau^2+4}$. Find the mean and variance of the process.
(g) State Winear – Khinchine theorem.
(h) State the properties of cross power spectral density.
(i) Define time invariant system.
(j) State any four properties of band-limited process.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 An urn contains 10 white and 3 black balls while another urn contains 3 white and 5 black balls. Two are drawn from the first urn and put into the second urn and then a ball is drawn from latter. What is the probability that it is a white ball?

OR

3 The number of cars arriving at certain bank drive in-window during any 10-minutes period is a Poisson random variable X with b = 2. Find;
(i) The probability that more than 3 cars will arrive during any 10-minutes period.
(ii) The probability that no cars will arrive.

UNIT – II

4 The joint probability density function of two random variables X and Y is given by $f(x,y) = \begin{cases} \frac{5}{16}x^2y, & 0 < y < x < 2 \\ 0, & elsewere \end{cases}$
(i) Find the marginal distributions of X and Y.
(ii) Are X and Y independent.

OR

5 Two random variables X and Y have the joint characteristic functions $\varphi_{XY}(\omega_1, \omega_2) = e^{(-2\omega_1^2 - 8\omega_2^2)}$. Show that X and Y are both zero-mean random variables and they are uncorrelated.

UNIT – III

6 Two random processes $\{X(t)\}$ and $\{Y(t)\}$ are defined by $X(t) = A\,cos\omega t + B\,sin\omega t$ and $Y(t) = B\,cos\omega t - A\,sin\omega t$ show that $\{X(t)\}$ and $\{Y(t)\}$ are jointly wide-sense stationary if A and B are uncorrelated random variables with zero means and the same variances and ω is constant.

OR

7 Find the auto correlation function of $\{Y(t)\}$ where $Y(t) = AX(t)\cos(\omega_0 t + \theta)$ where $\{X(t)\}$ is a zero mean stationary random process with auto correlation function $R_{XX}(\tau)$, $A\ and\ \omega_0$ are constants and θ is uniformly distributed random variable on the interval $(0, 2\pi)$ and independent of $\{X(t)\}$.

Contd. in page 2

UNIT – IV

8 Find the power spectral density of the random process $X(t) = A\cos(\omega t + \theta)$, where A and ω are constants and θ is uniformly distributed random variable on the interval $(0, 2\pi)$.

OR

9 Find the power spectral density of WSS process with auto correlation
$R_{XX}(\tau) = e^{-\alpha\tau^2}$, where α is a constant.

UNIT – V

10 If $\{X(t)\}$ is a WSS process and if $y(t) = \int_{-\infty}^{\infty} h(u)X(t-u)du$ then prove that;
(i) $R_{YY}(\tau) = R_{XY}(\tau) * h(-\tau)$
(ii) $S_{XY}(\omega) = S_{XX}(\omega)\ H*(\omega)$

OR

11 A random process $\{X(t)\}$ having auto correlation function;
$R_{XX}(\tau) = e^{-P|\tau|}$, where P and α are real constant, is applied to the input of a system with impulse response $h(t) = \begin{cases} We^{-Wt}, & 0 < t \\ 0, & t < 0 \end{cases}$ where W is a real positive constant. Find the autocorrelation function of the network's response $Y(t)$.

*****

Code: 15A04304 **R15**

B.Tech II Year I Semester (R15) Regular & Supplementary Examinations November/December 2017

PROBABILITY THEORY & STOCHASTIC PROCESSES

(Electronics & Communication Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

*****

1 Answer the following: (10 X 02 = 20 Marks)

(a) A man is known to speak the truth 2 out of 3 times. He throws a die and reports that it is a one. Find the probability it is actually one.

(b) A Continuous random variable X as a probability density function $f(x) = 3x^2$ for $0 \le x \le 1$. Find a and b such that: (i) $P\{X \le a\} = P\{X > a\}$ (ii) $P\{X > b\} = 0.05$

(c) The joint density function $g(x, y) = bx^{-x} \cos y$ for $0 < x < 2$ and $0 < y < \pi/2$. If $g(x, y)$ is a valid density function then find 'b' Value.

(d) Show that the mean value of a weighted sum of random variables equals the weighted sum of mean values.

(e) A random process X(t) = At, Where A is uniformly distributed random variable over the interval (0,2). Find the mean value of the process.

(f) Define wide sense stationary process?

(g) The auto correlation function of a random process $R_{XX}(\tau) = A0^2 \cos \tau$. Find the power spectral density.

(h) Define cross power spectral density

(i) Bring out the differences between narrowband and broadband noises.

(j) X(t) is a stationary random process with zero and auto correlation $R_{XX}(\tau) = e^{-2|\tau|}$ is applied to a system of function $H(w) = \frac{1}{jw + 2}$. Find mean PSD of its output.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) State and prove the Baye's theorem.

(b) Assume automobile arrivals at a gasoline station are Poisson and occur an average rate of 50 / hour. The station has only one gasoline pump. If all cars are assumed to require one minute to obtain fuel. What is the probability that a waiting line will occur at the pump?

OR

3 (a) Define Gaussian density functions and derive the Gaussian distribution function.

(b) A pair of fair dice is thrown in a gambling problem. Person A wins if the sum of numbers showing up is six or less and one of the dice shows four. Person B wins if the sum is 5 or more and one of the dice shows a four. Find: (i) The probability that A wins. (ii) The probability of B winning. (iii) The probability that both A and B wins.

UNIT – II

4 (a) Two random variables X and Y have a joint probability density function:

$$f_{X,Y}(x, y) = \begin{cases} \frac{5}{16} x^2 y & 0 < y < x < 2 \\ 0 & \text{elsewhere} \end{cases}$$

(i) Find the marginal density functions of X and Y. (ii) Are X and Y statistically independent?

(b) Two random variables Y_1,Y_2 are defined as

$Y_1 = X\cos\theta + Y\sin\theta$

$Y_2 = -X\sin\theta + Y\cos\theta$

Find the co-variance between Y_1 and Y_2.

OR

5 (a) State all the properties of joint probability density function.

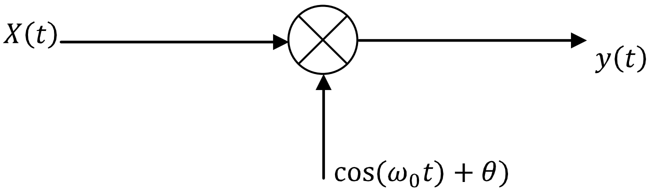
(b) If the joint probability density function of X, Y is given by $f_{X,Y}(x, y) = x+y$ for 0<x, y<1. Find the probability density function of U = XY.

Contd. in page 2

UNIT – III

6 (a) Discuss in detail about: (i) First order stationary random process. (ii) Ergodic process.

(b) $X(t)$ be a wide sense stationarity random process with autocorrelation function $R_{xx}(\tau) = e^{-a|\tau|}, a > 0$. $X(t)$ is a "Amplitude modulates" a "carrier" $\cos(\omega_0 t + \theta)$ as shown in below figure. Here θ is a random variable uniform on $(-\pi, \pi)$. Show that the process $y(t)$is a wide sense stationarity process.



OR

7 (a) State and prove the all properties of cross correlation function.

(b) The auto correlation function for a stationary process X(t) is given by $R_{XX}(\tau) = 9 + 2e^{-|\tau|}$. Find the mean and variance of $Y = \int_0^2 x(t)dt$.

UNIT – IV

8 (a) "The power spectral density of any random waveform and its autocorrelation function are related by means of Fourier transform". Prove and illustrate the above statement.

(b) A random process $X(t) = Acos(\omega_0 t + \theta)$, where A_0, ω_0 constants and θ is a variable uniformly distributed on the interval $(0, \pi/2)$. Find the average power?

OR

9 (a) Derive the expression for cross power spectral density?

(b) The cross correlation function of any two random processes X(t) and Y(t) is:

$$R_{XY}(t, t+) = AB/2\ sinw_0 + cos\ w_0(2t + w_0)\ for\ -T < t < T.$$

Find the cross power spectral density.

UNIT – V

10 (a) Show that a narrow band noise process can be expressed as in-phase and quadrature components of it.

(b) The input voltage to an RLC series Circuit is a stationary random process X(t) with E[x(t)] = 2 and $R_{XX}(\tau) = 4 + e^{-2|\tau|}$. Let Y(t) be the voltage across capacitor. Find E[Y(t)].

OR

11 (a) Define and explain the following random process: (i) Band pass. (ii) Band limited. (iii) Narrowband.

(b) A mixer stage has a noise figure of 20dB and this is preceded by a amplifier that has a noise figure of 9dB and an available power gain 15dB. Calculate the overall noise figure referred to the input.

*****

Code: 15A04304 **R15**

B.Tech II Year I Semester (R15) Supplementary Examinations June 2017

PROBABILITY THEORY & STOCHASTIC PROCESSES

(Electronics & Communication Engineering)

Time: 3 hours Max. Marks: 70

PART - A

(Compulsory Question)

*****

1 Answer the following: (10 X 02 = 20 Marks)

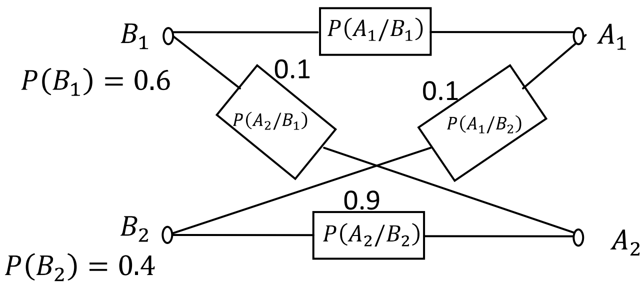
- (a) Write the axioms of probability.
- (b) A fair die is rolled 5 times. Find the probability that "six" will show 2 times.
- (c) State central limit theorem.
- (d) Define correlation coefficient.
- (e) A random process $X(t) = A\ Sin\omega_0 t$, where ω_0 is constant and 'A' is a uniform random variable over the interval (0, 1). Find whether X(t) is a stationary process or not.
- (f) State autocorrelation properties.
- (g) Find the PSD if $R_{XX}(\tau)$ is given as $e^{-2\lambda|\tau|}$.
- (h) Calculate the noise equivalent bandwidth of the filter defined with transfer function: $H(f) = \frac{1}{1+J2\pi fRC}$.
- (i) For a random variable with a CDF: $F_X(x) = (1 - e^{-x})\, u(x)$. Find $\Pr(X > 5)$ and $\Pr(X > 5/X < 7)$.
- (j) State Wiener – Khintchine theorem.

PART - B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT - I

2 (a) A binary symmetric channel is shown in below. Find the probability of (i) A_1, (ii) A_2, (iii) $P(B_1/A_1)$. (iv) $P(B_2/A_2)$. (v) $P(B_1/A_2)$. (vi) $P(B_2/A_1)$.



(b) List the properties of conditional density function.

OR

3 (a) Write and plot probability density function and probability distribution function of the following random variables:

(i) Uniform random variable.

(ii) Exponential random variable.

(iii) Laplace random variable.

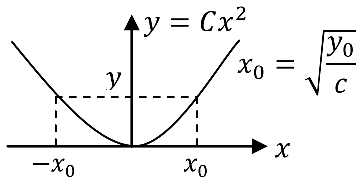
(iv) Rayleigh random variable.

(b) A random variable X is defined as below, over the interval (0, 1). Find its conditional CDF of X given that $X < \frac{1}{2}$; $F_X(x) = \begin{cases} 0, & x < 0 \\ x, & 0 \le x < 1 \\ 1, & x > 1 \end{cases}$

Contd. in page 2

UNIT - II

4 (a) Find $f_Y(y)$ for the square law transfamation Y = T(X) = Cx^2 shown below.



(b) Find whether the two random variables X, and Y are statistically independent or not if the joint p.d.f is given by $f_{XY}(x,y) = \frac{1}{12}\, u(x)\, u(y)\, e^{-\left(\frac{x}{4}\right)-\left(\frac{y}{3}\right)}$.

OR

5 (a) Find the p.d.f of a random variable W defined as sum of X, Y with densities shown below;

$f_X(x) = \frac{1}{a}[u(x) - u(x-a)]$

$f_Y(y) = \frac{1}{b}[u(y) - u(y-b)]$

With a<b

(b) An exponential random variable has a p.d.f as shown below $f_X(x) = be^{-bx}\, u(x)$ with mean value $\frac{1}{b}$. Find its coefficient of skewness and kurtosis.

UNIT - III

6 (a) Two random process X(t) and Y(t) defined as below

$X(t) = A\, Cos\omega_0 t + B\, Sin\omega_0 t$

$Y(t) = B\, Cos\omega_0 t - A\, Sin\omega_0 t$

Where A, B are uncorrelated random variables with mean '0' and same variance and ω_0 is constant. Find whether X(t) and Y(t) are jointly wide-sense stationary or not.

(b) A random process $X(t) = a\, Sin(\omega_0 t + \theta)$ where θ is uniform over $[0, 2\pi]$. Find whether it is ergodic or not.

OR

7 (a) Find the mean, variance of the process X(A), with ACF given as $R_{XX}(\tau) = 25 + \frac{4}{1+6\tau^2}$.

(b) Define Poisson random process and list the conditions. Write the p.d.f and find its mean and variance.

UNIT - IV

8 (a) State the properties of power density spectrum.

(b) Find power spectrum of WSS noise process N(t) with autocorrelation function defined as below. $R_{NN}(\tau) = Pe^{-3|\tau|}$

OR

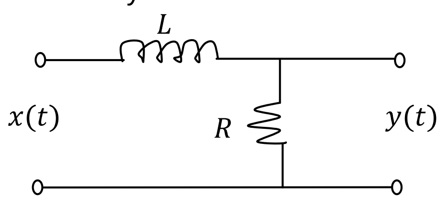
9 (a) List the properties of cross-power density spectrum.

(b) Find the cross-correlation function for a cross-power density spectrum given below:

$f_{XY}(\omega) = \frac{8}{(\alpha + j\omega)^3}$

UNIT - V

10 Find the output power for the LTI system shown below with input power spectral density $f_{XY}(\omega) = \frac{N_0}{2}$.



OR

11 For LTI system with impulse response h(t), input X(t), and output Y(t). Prove the following:

(i) $\mu_Y(t) = \mu_X\, H(0)$ (ii) $R_{YY}(\tau) = R_{XX}(\tau) * h(\tau) * h(-\tau)$

(iii) $f_{YY}(f) = f_{XX}(f)\ |H(f)|^2$ (iv) $f_{XY}(f) = f_{XX}(f)\, H(f)$

*****

Code: 15A04304

R15

B.Tech II Year I Semester (R15) Supplementary Examinations June 2018

PROBABILITY THEORY & STOCHASTIC PROCESSES

(Electronics & Communication Engineering)

Time: 3 hours | Max. Marks: 70

PART – A

(Compulsory Question)

*****

1 Answer the following: (10 X 02 = 20 Marks)

(a) What are the different types of sample spaces?
(b) Define Poisson random variable.
(c) Define central limit theorem.
(d) What is linear transformation of random variable?
(e) What is mean ergodic processes?
(f) Define covariance of two random variables.
(g) What is power spectrum density?
(h) Define cross correlation function of two variables.
(i) Define convolution.
(j) Define cross power density spectrum.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 Discuss in detail about the conditional probability with example

OR

3 The number of calls received in a telephone exchange follows a Poisson distribution with an average of 10 calls per minute. What is the probability that in one-minute duration? (i) No call is received. (ii) Exactly 5 calls are received. (iii) More than 3 calls are received.

UNIT – II

4 State and prove any four properties of joint distribution function.

OR

5 Discuss briefly about the linear transformations of random variables.

UNIT – III

6 Explain in detail the wide sense stationary process with necessary expressions.

OR

7 Discuss in detail the deterministic and nondeterministic random processes.

UNIT – IV

8 State and prove the properties of cross power density spectrum.

OR

9 Discuss in detail the relationship between power spectrum and autocorrelation function with necessary expressions.

UNIT – V

10 Explain in detail the cross correlation functions of input and the output of a LTI systems.

OR

11 Explain the properties of power spectral density.

*****

Code: 15A04304 **R15**

B.Tech II Year I Semester (R15) Regular Examinations November/December 2016

PROBABILITY THEORY & STOCHASTIC PROCESSES

(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

*****

1 Answer the following: (10 X 02 = 20 Marks)

(a) What is the condition for a function to be a random variable?

(b) Define Gaussian random variable.

(c) How interval conditioning is different from point conditioning?

(d) When N random variables are said to be jointly Gaussian?

(e) Explain about strict-sense stationery processes.

(f) Where the Poisson random processes is used? Explain.

(g) Examine the function $\frac{\omega^2}{\omega^6 + 3\omega^2 + 3}$ for valid PSD.

(h) Correlate CPSD and CCF.

(i) Analyze the power density spectrum of response.

(j) List the properties of band limited processes.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) Give Classical and Axiomatic definitions of Probability.

(b) In a single through of two dice, what is the probability of obtaining a sum of at least 10?

OR

3 (a) What is the concept of Random Variable? Explain with a suitable example.

(b) A random variable X has the distribution function:

$$F_X(x) = \sum_{n=1}^{12} \frac{n^2}{650} u(x-n)$$

Find the probabilities (i) P{-∞< X ≤ 6.5}. (ii) P{X > 4} (iii) P{6 < X ≤ 9}.

UNIT – II

4 (a) State and explain the central limit theorem.

(b) Given the function:

$$f_{XY}(x,y) = \begin{cases} b(x+y)^2, & -2 < x < 2,\ -3 < y < 3 \\ 0, & \text{elsewhere} \end{cases}.$$

(i) Find a constant 'b' such that this is a valid density function.

(ii) Determine the marginal density functions $f_x(x)$ and $f_y(y)$.

OR

5 (a) What are the properties of Jointly Gaussian Random variables?

(b) A random variable X has $\overline{X} = -3, \overline{X^2} = 11, and\ \sigma_x^2 = 2$. For a new random variable Y= 2X-3, find: (i) $\overline{Y}$. (ii) $\overline{Y^2}$. (iii) σ_y^2.

Contd. in page 2

UNIT – III

6 (a) List and explain various properties of Autocorrelation function.

(b) Given the Autocorrelation function of the processes:

$$R_{XX}(\tau) = 25 + \frac{4}{1 + 6\tau^2}$$

Find the mean and variance of the process X(t).

OR

7 (a) Compare the Cross Correlation Function with Autocorrelation function.

(b) Assume that an Ergodic random process X(t) has an autocorrelation function:

$$R_{XX}(\tau) = 18 + \frac{2}{6 + \tau^2}[1 + 4\cos(12\tau)]$$

(i) Find $|\overline{X}|$. (ii) Does this process have periodic component? (iii)What is the average power in X(t)?

UNIT – IV

8 (a) State and explain the Wiener-Khintchine relation.

(b) Obtain the auto correlation function corresponding to the power density spectrum:

$$S_{XX}(\omega) = \frac{8}{(9 + \omega^2)^2}$$

OR

9 (a) Define Power Spectral Density? List out its properties.

(b) Compute the average power of the process having power spectral density $\frac{6\omega^2}{1+\omega^4}$.

UNIT – V

10 (a) What is LTI system? How the response can be obtained from LTI system.

(b) Find the system response, when a signal x(t)= u(t) e^{-2t} is applied to a network having an impulse response h(t) = 3u(t) e^{-3t}.

OR

11 (a) Explain about mean and mean square value of system response?

(b) A random process X(t) is applied to a network with impulse response: h(t) = u(t) t e^{-3t}. The cross correlation of X(t) with the output Y(t) is known to have the same form $R_{XX}(\tau) = u(\tau)\, \tau\, e^{-3\tau}$.

(i) Find the autocorrelation of Y(t).

(ii)What is the average power in Y(t)

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Code: 15A04304 **R15**

B.Tech II Year I Semester (R15) Regular & Supplementary Examinations November/December 2018

PROBABILITY THEORY & STOCHASTIC PROCESSES

(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

*****

1 Answer the following: (10 X 02 = 20 Marks)

(a) Define the distribution function of a discrete random variable X.

(b) When two events are said to be independent?

(c) How to compute the probability of an event $P\{x_1 < X \leq x_2\}$ by using distribution function $F_x(X)$?

(d) If the variance of a random variable X is Var(X), then the variance of a random variable Y = aX is.

(e) Statistically independent zero-mean random processes X(t) and Y(y) have autocorrelation functions $R_{XX}(\tau)$ and $R_{yy}(\tau)$, then ACF of 'X(t) + Y(t)' is.

(f) What is the second order moment of the random processes X(t) if $R_{XX}(\tau) = \frac{16}{1+6\tau^2}$?

(g) Why the function S_{XY}(w) = 3 + jw^2 is a valid CPSD?

(h) Average power of Random processes X(t) = Acos (wt+Θ), where Θ is RV.

(i) Define narrow band process.

(j) Obtain the ratio between output PSD S_{YY}(w) to input PSD S_{XX}(w) from magnitude spectrum: $|H(w)| = \frac{4}{\sqrt{3+\omega^2}}$.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 A random variable X has the distribution function: $F_X(X) = \sum_{n=1}^{12} \frac{n^2}{650} u(x-n)$ evaluate the probability: (i) $P\{-\infty < X \leq 6.5\}$. (ii) P(X> 4} (iii) P{6 $< X \leq 9\}$.

OR

3 Assume automobile arrivals at a gasoline station are Poisson and occurs at an average rate of 50per/Hour. The station has only one gasoline pump. If all cars are assumed to require one minute to obtain fuel, What is the probability that a weighting line will occur at the pump.

UNIT – II

4 Two random variables X and Y have means $\bar{X}$ = 1 and $\bar{Y}$ = 2 variances $\sigma_X^2 = 4$ and $\sigma_Y^2 = 1$ and a correlation coefficient $\rho_{XY} = 0.4$. New random variables W and V are defined by V = -X + 2Y, W = X + 3Y. Find: (i) The means. (ii) The variances. (iii) The correlations. (iv) The correlation coefficient ρ_{VW} of V and W.

OR

5 Let X & Y be statically independent random variables with $\bar{X} = \frac{3}{4}, \overline{X^2} = 4, \bar{Y} = 1, \overline{Y^2} = 5$. For a random variable W = X-2Y+1, then calculate: (i) R_{XY}. (ii) R_{XW}. (iii) C_{XY} and verify X & Y are uncorrelated or not.

Contd. in page 2

UNIT – III

6 If $X(t) = A\,Cos(\omega_0 t + \theta), whre\ A,\ \omega_0$ are constants, and θ is a uniform random variable on $(-\pi, \pi)$. A new random process is defined by $Y(t) = X^2(t)$.
(i) Obtain the mean and auto correlation function of $X(t)$.
(ii) Obtain the mean and auto correlation function of $Y(t)$.
(iii) Find the cross correlation function of $X(t)$ & $Y(t)$.
(iv) Are $X(t)$ and $Y(t)$ are WSS.
(V) Are $X(t)$ & $Y(t)$ are jointly WSS.

OR

7 Two random process $X(t)$ & $Y(t)$ are defined as:
$X(t) = A\,Cos(\omega_0 t) + B\,Sin(\omega_0 t),\ Y(t) = B\,Cos(\omega_0 t) - A\,Sin(\omega_0 t),$ A, B are uncorrelated, zero mean random variables with same variance, ω_0 is constant: (i) Determine $R_{XY}(t, t+\tau)$. (ii) check $X(t),\ Y(t)$ are jointly WSS or not.

UNIT – IV

8 Suppose the cross power spectrum is defined by:

$$S_{XY}(\omega) = a + \frac{jb\omega}{W}, -W \le \omega \le W$$
$$0, \quad Otherwise$$

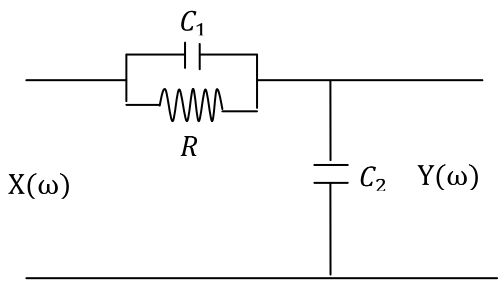
Where a, b are real constants, then obtain cross correlation functions $R_{XY}(\tau)$ and $R_{YX}(\tau)$.

OR

9 Determine the cross correlation function, whose cross PSD is
$S_{XY}(\omega) = \frac{8}{(\alpha + j\omega)^3}$ and also find $S_{YX}(\omega),\ R_{YX}(\omega)$.

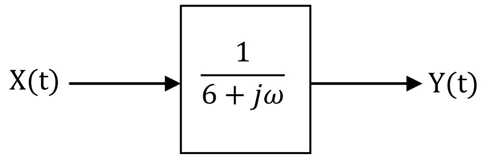
UNIT – V

10 Obtain the transfer function $H(\omega)$ of the network as shown in figure below if C_1 = 5F, C_2 = 10F and $R = 10\Omega$, then determine $S_{XY}(\omega)$ if $R_{XX}(\tau) = 5\,\delta(\tau)$.



OR

11 Consider a linear system as shown in figure below.



If ACF of input $R_{XX}(\tau) = 5\,\delta(\tau)$, then determine: (i) ACF of response. (ii) PSD of response. (iii) Mean square value of response.

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