Code: 9A04303 **1**

B.Tech II Year II Semester (R09) Regular & Supplementary Examinations, April/May 2013

PROBABILITY THEORY AND STOCHASTIC PROCESSES

(Electronics and Computer Engineering)

Time: 3 hours Max Marks: 70

Answer any FIVE questions

All questions carry equal marks

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1 (a) Define:
   (i) Probability.
   (ii) Certain event.
   (iii) Impossible event.
  (b) Define and explain the following with examples:
   (i) Discrete sample space.
   (ii) Continuous sample space.

2 (a) Explain with an example discrete, continuous and mixed random variables.
  (b) Explain CDF with its properties.

3 Explain about the following:
  (a) Expected value of a random variable.
  (b) Explain value of a function of a random variable.

4 (a) Explain the conditional distribution of density functions for points and interval conditionin.
  (b) Explain the statistical independence of two random variables.

5 (a) An event has six possible outcomes with probabilities P1 =1/2, P2 = 1/4, P3 = 1/8, P4 = 1/16, P5 = 1/32 and P6= 1/32. Find the entropy of the system and also find the rate of information if there are 16 outcomes per second.
  (b) Explain about bandwidth and SNR trade-off.

6 (a) What are the differences between determinate and non determinate random processes? Explain each with an example.
  (b) Explain the classification of random process with neat sketches.

7 (a) State and prove the properties of cross correlation function.
  (b) Prove the auto correlation function of a random process is even function of ($\mathcal{T}$).

8 Explain PSD and mention the properties of PSD with proofs.

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1 (a) Explain the following:

(i) Random experiment. (ii) Trail. (iii) Event. (iv) Sample space.

(b) Find the probability of obtaining 14 with 3 dice using Baye's theorem.

2 Define and explain the following density functions:

(a) Binomial.

(b) Exponential.

3 (a) Probability density function of a random variable X = 1/2 sinx 0$< x < \pi = 0$ elsewhere find the mean mode and median for the distribution and also find the probability between 0 and $\pi/2$.

(b) Two dice one thrown five times. If getting a double of is a success. Find the probability that getting the success (i) at least once. (ii) two times.

4 (a) State and explain 'Central limit theorem'.

(b) Explain the envelope of narrow band noise.

5 (a) Write short notes on joint moments about the origin.

(b) X' is a random variable with mean '4' and variance '3'. Another random variable 'Y' is re 'X' as Y = 2 X+7. Determine: (i) E [X^2] (ii) E [Y] (iii) var [Y] (iv) RXY.

6 (a) Differentiate WSS and SSS.

(b) Explain the classification of random process with neat sketches.

7 (a) Derive the expression for PSD and ACF of band pan white noise and plot them.

(b) Define various types of noise and explain.

8 (a) State and explain source coding theorem.

(b) Find the density function whose characteristic function is exp (-|t|).

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1 (a) Explain the relative frequency definition and axiomatic definition of probability.

(b) If two events A and B are independent show that:

(i) A' and B' are independent.

(ii) A and B are independent.

(iii) A' and B' are independent.

2 (a) Define the joint distribution function. Explain how marginal density functions are computed given their joint distribution functions.

(b) Explain conditions for a function to be a random variable.

3 (a) Explain about moments of random variable.

(b) Explain the properties of characteristic function of a random variable.

4 (a) Differentiate marginal and conditional distributions functions.

(b) Find the value of constant b so that the function $f_{x,y}(x,y) = bxy^2 \exp(-2xy)\, u(x-2)u(y-1)$ is a valid joint probability density.

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

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

6 (a) What are the causes of thermal noise?

(b) What are the causes of short noise?

7 A random process is defined by x (t) = At where A is a continuous random variable uniformly distributed on (0, 1) and t represents time. Find

(a) E [x (t)]

(b) R_{xx} [t,t+τ]

(c) Is the process stationary?

8 (a) Describe the channel capacity of a discrete channel.

(b) Explain Shannon-Fano algorithm to develop a code to increase average formation per bit.

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PROBABILITY THEORY AND STOCHASTIC PROCESSES

(Electronics and Computer Engineering)

Time: 3 hours Max Marks: 70

Answer any FIVE questions
All questions carry equal marks
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1 (a) Explain the following: (i) Random experiment. (ii) Trial. (iii) Event. (iv) Sample space.
(b) Find the probability of obtaining 14 with 3 dice using Baye's theorem.

2 (a) Write the distribution and density functions with properties.
(b) Discuss about uniform distribution and exponential distribution.

3 (a) Explain about moments of random variable.
(b) Explain the properties of characteristic function of a random variable.

4 (a) Explain the statistical independence of two random variables.
(b) A joint sample space for two random variables X and Y has four elements (1, 1), (2, 2), (3, 3), and (4, 4).
Probabilities of these events are 0.1,0.35,0.05 and 0.5 respectively
(i) Find the probability of the event $\{x \leq 2.5, Y \leq 6\}$.
(ii) Find the probability of the event $\{x \leq 3\}$.

5 (a) Show that the mean value of weighted sum of random variables equal the weighted sum of mean values.
(b) Derive the marginal characteristic functions.

6 Discuss in detailed about:
(a) First order stationary random process.
(b) Second order and wide-sense stationary random process.

7 (a) What are the precautions to be taken in cascading stages of a network in the point of view of noise reduction?
(b) What is the need for band limiting the signal towards the direction increasing SNR?

8 (a) Describe the channel capacity of a discrete channel.
(b) Explain Shannon-Fano algorithm to develop a code to increase average formation per bit.

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